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CONTENTS

Editorial 135

Corrosion and Its Prevention in the Plating Room—Conclusion—By Alfred Baechlin, Jr. 136

Black Oxide Coatings on Stainless Steel—By Irvine Clingan 139

Dyeing Chromic Acid Anodized Aluminum—Colored Finishes—By Marc Darrin and L. G. Tubbs 141

The Nature of Foreign Deposits on Metal Surfaces—By P. D. Liddiard 145

DEPARTMENTS

This Is Washington 148
Dictionary of Metal Finishing Chemicals 151
Shop Problems 153
Patents 154
New Equipment and Supplies 156
Business Items 160
Associations 162
News from California 164
Manufacturers' Literature 165
Obituaries 168
Odds and Ends 50

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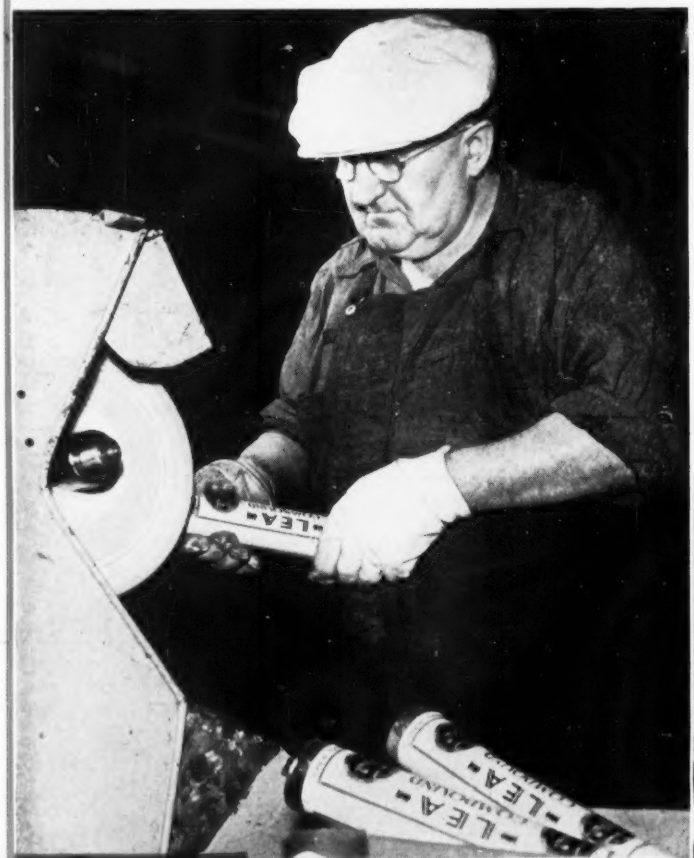

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VOL. 42, NO. 3 METAL FINISHING MARCH, 1944
PREPARATION, ELECTROPLATING, COATING

IS THE METAL SITUATION IMPROVING?

Easing of the metal situation to a considerable extent during the next few months is the expectation of industry, based on reports of surpluses and relaxation of restrictions in a number of cases. Alloys containing cobalt, chromium, tungsten, nickel, molybdenum, vanadium, or secondary aluminum, used for hard facing purposes, have been removed from restriction. Permission has been granted to use normal amounts of iron and steel for the maufacture of baby carriages, and makers of jewelry can use 50 per cent more gold and palladium than they have been permitted to use since July 1, 1943, although in the latter case, the original restriction was for the purpose of forcing jewelry workers into war work rather than for conservation of the metals.

Recent developments, however, would seem to indicate that users of copper, brass and silver for non-essential purposes are not to expect any relief in the very near future. The War Production Board has branded as erroneous the widely repeated report that, as a result of reduction in the small arms program, copper and brass have become plentiful enough to make possible large scale relaxation of the control over these metals. The supply of copper is now in balance with demand, but the balance is so close that so far it has been possible to permit slightly increased use of copper only for a few essential items that are directly or indirectly connected with the war effort.

Although the costume jewelry manufacturers are hopeful of obtaining release of inventories of semi-fabricated and fully fabricated copper and copper-base alloy which have been frozen in their hands for almost two years, fountain pen and mechanical pencil manufacturers have been informed that brass cannot be made available for production of the pre-war type pens and pencils in the near future.

In the case of silver, it is estimated that, if imports continue at the present curtailed rate, there will be a need for some 50-75 million ounces of Treasury "free" silver for use in essential civilian and war industries, without taking into account several potential major new uses now on the horizon. It therefore has appeared inadvisable, at this time, to consider relaxation of present restrictions in the use of silver for less essential purposes, such as jewelry and silverware, since any increase in such uses would have to be met largely from Treasury stocks of "free" silver.

The metal situation may be improving but under the present conditions it is not believed that the prevailing feeling of optimism is warranted.

Corrosion and Its Prevention in the Plating Room

By ALFRED BAECHLIN, JR.

Bayonne, New Jersey

CONCLUSION

IT IS difficult to lay down any set rule as to what type of floor to use since each has its own advantages when used in a particular application and no two are exactly the same. The design engineer who is cost conscious will study the application of each type of floor to his particular installation and judge therefrom which will be the appropriate one to use, based on best operation, least maintenance and lowest cost, plus any number of other points which may carry particular weight depending on the application.

Flooring Materials

The substance of which the floor will be made is an important item from a corrosion standpoint. Various materials have been used successfully but again the engineer must keep in mind that any one material will not apply satisfactorily to all jobs, particularly the cheaper materials.

CLAY FLOORS have been used where it was desired to keep the cost down to a minimum and obtain a quick, temporary installation. Clay and dirt floors are not satisfactory in the usual installation because they must continually be re-surfaced and they are subject to abrasion when wet. They are also slippery when moist and do not withstand high concentration of acids and alkalis. It is difficult to construct trenches which remain permanent from clay.

WOOD is frequently used but generally only as a base or support for a waterproof layer of chemically resistant material. There are many wood floors in use today which are merely covered with asphalt and slag similar to outside roofs. Walkways are generally provided for the workmen in order to protect the floor. This type of surfacing will run about 15c per square foot and provides an extremely cheap floor. It is, of course, not of a very permanent nature and could easily be punctured. It is not to be recommended for use over occupied areas. Instead of roofing material, hot or cold mastics are often applied over a wood floor with a membrane in between. This membrane is composed of an asphaltic cement which usually has a melting point of around 250°F. and yet maintains a reasonably flexible state at low temperatures. The membrane is generally not over 1/8" in thickness. After this has been allowed to set, either a hot or cold mastic coating is applied which protects the membrane and adds to the resistivity of the floor. This treatment will cost around 35c per square foot with a hot mastic surface and about 20c per square foot with cold mastic. The floor will be reasonably satisfactory but must be kept free from walking or any form of abrasion to be maintained so. It is readily punctured if, for instance, heavy, sharp metal parts rest on the floor or are dropped there.

Fig. 5. The receiving sump from a typical pitched floor. Note the wooden grating. The pipe carries an alkaline solution to neutralize the acids before they are conducted to the sewer.

HOT OR COLD MASTIC over concrete is better since the hazard of immediate leaks through the floor is reduced, should the floor become punctured. This, however, makes a more expensive floor unless the concrete base is already installed.

ACID BRICK OR TILE FLOORS, properly laid, are without a par for permanence, stability and maximum resistance to all types of acids and alkalis. The exact nature of the brick or tile varies somewhat with the exposure to which it is subjected but, generally speaking, the material used for plating room floors should be dense, de-aired, hard burned and specially scored for adhesion. The joints between the brick can be either cement, asphalt or a special sulphur base cement developed for maximum resistance to acid solutions. Floor of the

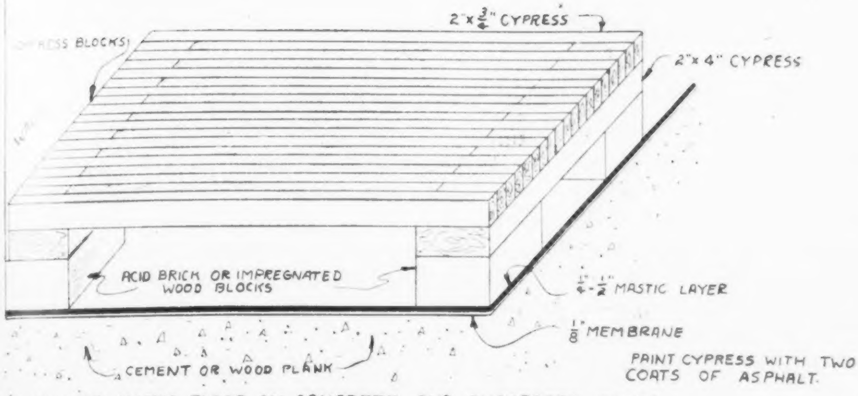


FIG. 6. ASPHALT MASTIC FLOOR ON CONCRETE AND DUCKBOARD FLOOR

tile or brick type are expensive but on a long term proposition make a good investment. A tile floor with ordinary cement joints and no curbing can usually be obtained for around 50-75 cents per square foot. With asphalt joints the cost will be about 60% higher and with special jointing cements the cost will run from $1.00 to $1.25 per square foot. Where special grading and filling must be done, the cost will be proportionally higher. Curbing will add 20-40% to the cost depending on the shape of the room.

Tile Floor Construction

The actual process of constructing the latter type of acid proof tile floor consists of first pouring a concrete base, using a fairly rich mix. This base is laid over the old floor or sometimes on the ground, depending on the application. It is made about 2 inches thick at the low end and then graded at least ⅛" to the foot to the high end The mix used is fairly dry so as to minimize settling of the floor as it dries and to provide a non-porous base

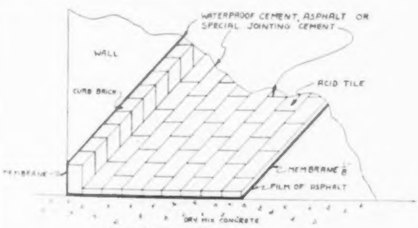


FIG. 7 CONSTRUCTION OF A TILE FLOOR

The finished surface is usually trowelled with a light coating of pure cement and water. This helps to fill up any small holes and further reduce the porosity. A minimum of two days is then allowed for the concrete to harden after which the whole surface is painted with liquid asphalt.

After one or two days, a membrane composed of an asphaltic and plastic sulphur compound which is chemically inert and has a tar-like consistency is poured over the floor while hot. This is distributed to about ⅛" average thickness. After this job is complete, the thickness is checked at several points to spot any thin areas. A good membrane will remain in a plastic, rubbery state down to 0°F. and should never harden. This allows for adequate differential expansion between the concrete base and the tile. The bricks or tiles are next laid, the first operation being to form a curb around the room which extends about 4" above the finished floor level. The bricks are then laid in a sulphur base cement and great care taken to close up all joints. This cement becomes very hard when dry and is as non-porous as the tile itself. The floor when complete should not be used for at least a week since the jointing compound hardens rather slowly.

Paint for Protection

PAINT is an important item in a plating room first, because of the protection against corrosion, it gives to valuable equipment and secondly because of the better working conditions it provides. There are any number of acid and alkali resistant paints on the market today and many of them are excellent protectors. It is unfortunate that very few are available in other than black or the darker colors. With present tendencies toward the use of light paints in industry because of better lighting and the inducement for cleanliness, these dark colors are not very popular except for painting piping and the smaller components of the room. The main reason for most of the chemically protective paints being dark is due to the fact that they contain an asphalt base. This adds to the problem when it is attempted to paint over the acid proof paint with a light color. The asphalt has a strong tendency to "leak" through the outer coat and discolor it. This in turn can be partially obviated by sealing the asphalt with a coat of aluminum paint if it is available or if not, other paints with similar characteristics. However, this makes a very costly painting job in order to secure a light color. There are one or two good chemically resistant paints on the market which actually come in light colors; even white, but they are expensive, hard to obtain and usually a greater number of coats are recommended for maxi-

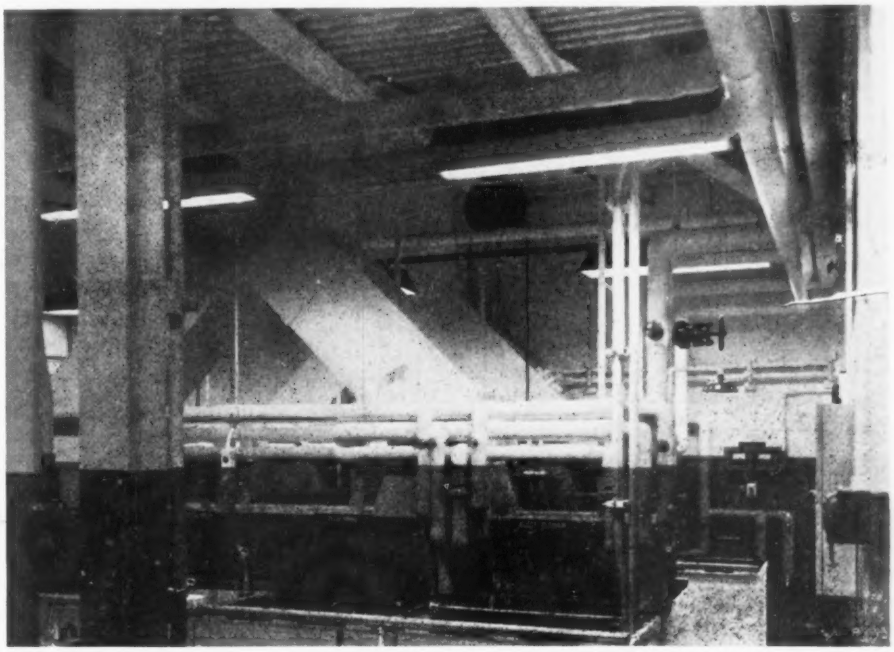


Fig. 8. Shows what can be done with paint in a plating room. The ductwork is made of Chemstone.

mum resistance including a special primer coat.

Plating room walls should be protected by acid proof paint to dado line height or higher. This will take care of the usual spillage and slopping. Several coats of good interior paint should serve as protection against the high humidity and light acid vapors around the ceiling providing a good exhaust system is installed.

In general, piping, electrical conduit, straps, etc., can be painted with the darker acid proof paints without destroying the lightness of the room. It is important to paint all piping whether insulated or not. Corrosive attack can be made through the average pipe insulation and not be noticed, making it doubly important to paint insulated piping. It is well to give the piping in the lower part of the room several extra coats since it is in more danger of being splashed with acids or alkalis. Window sash made of metal or wood should be treated with an acid proof paint since they are exposed to concentrations of acid due to condensation and collection of the warm plating room vapors on the glass during cold weather.

The outside walls of tanks of metal or wood should be given a protection of acid proof paint, preferably of a light color since they present a large surface to the light. There is another advantage to light colors in that the operators seem to be more conscious of dirt and spillage due to its conspicuousness on a light surface, and take more care not to dirty it, or if they do, they usually are more careful to clean it up. This has made a noticeable difference in the cleanliness of many plating rooms where it has been tried. It is no secret today that light colors in a working area are definitely conducive to better morale.

Protecting Exhaust Ducts

Ductwork if made of chemically inert material need not be coated with acid proof paint but can be given a few coats of ordinary light indoor paint. Since corrosion resistant duct material usually contains asphalt, it will be necessary to first apply a primer coat to seal against the asphalt leaking through the top coat. Metal ducts will require an acid proof paint since the galvanizing will last but a short time if not protected. The light color variety should be used if possible, since exhaust ductwork in plating rooms consists of large sections and presents considerable area to reflect or absorb light depending on the color.

In connection with painting ductwork or any other parts of the plating room where there are likely to be small cracks or openings (such as at the joints or seams in metal ducts) it is better to spray the paint than to brush it, at least on the first one or two coats. When using a spray gun, the paint is less viscous and is under pressure, which will insure its getting in the crack and providing protection at a very vulnerable point for corrosion attack. The final coat can be brushed if desired and the heavier paint will fill in the smaller cracks and bond with the spray coat already inside. This will prevent peeling at these points. When metal exhaust ductwork is used, the inside should be given two or three coats of heavy black asphaltum or, better still, the recommended number of coats of a good acid and alkali resistant paint. Of course, in connection with this, access should be left in the ductwork for future maintenance painting.

Protecting the Accessories

There are generally one or more instruments in every efficient plating room. These may be automatic tank temperature regulators, pH controllers and indicators, voltage and current meters, etc. Within the cases are extremely delicate and valuable mechanisms which cannot withstand either alkali or acid even in dilute form. The cases of all good instruments of this kind which are designed for plating room and chemical laboratory applications are equipped with a special gasketted cover or door to prevent any passage of the room air into the instrument. In cases where standard meters or other controls not equipped with vapor proof cases are used, the engineer should provide a vapor proof box with a glass front to give this protection. An inexpensive box, sufficiently tight can be made from plywood and given several coats of acid and alkali proof paint. The cover can be either hinged or screwed, with a rubber gasket, depending on how often it is necessary to gain access to the device. Any pipe or conduit which may enter the box will, of course, have to be made tight. This can be done by cutting the hole slightly smaller than the thread of a bushing and inserting this of proper size to take the pipe or conduit. Use acid and alkali paint on the threads when inserting both bushing and pipe. Such a box, if kept painted, will last indefinitely and keep the instrument inside like new as far as corrosion is concerned. This will not only improve the appearance of the room but will repay its original cost many times over when compared to the replacement cost of this expensive equipment, not to mention the gradual inaccuracy introduced over a period of time as the corrosion is proceeding and until the device fails entirely.

A discussion of vapor proof fixtures should not neglect electric fixtures such as switches, lights, motors, etc. It is, of course, advisable to keep these items outside of the room whenever possible but this is not always practical, especially in connection with proper lighting. Vapor proof fixtures of both the fluorescent and incandescent variety are available and should always be used in the plating room. They are naturally expensive, but the extra initial cost is amply justified. Switches and receptacles also are made in vapor proof types by several of the larger manufacturers.

(*Concluded on page* 155)

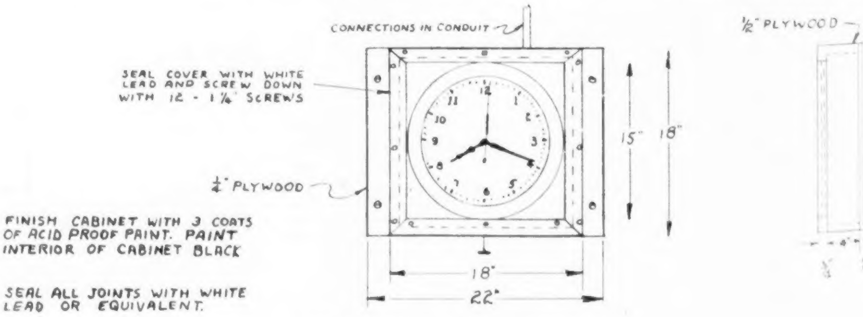


FIG. 9.. VAPOR PROOF CABINET FOR PLATING ROOM CLOCK.

Black Oxide Coatings on Stainless Steels

By IRVINE CLINGAN

Research Chemist, Rustless Iron & Steel Corp., Baltimore, Md.

Introduction

CHEMICAL and electrochemical processes commonly employed for blackening steels have not proved satisfactory for stainless steels[1]. Solutions used are generally of the oxidizing type, and in them the stainless steels are passive, resisting chemical change.

Black or dark colored finishes have assumed a position of importance in the use of stainless steel parts for some applications. This is particularly true where reflective or bright surfaces may be undesirable or even prohibitive, as in certain armament parts. Commercially, this need is being met through the application of pigments, enamels, japans, electroplated coatings, by tempering, and other similar methods. These coatings have not proved adequate in service either because of brittleness, poor adhesion, low resistance to wear and abrasion, or because of poor corrosion resistance.

Normally, stainless steels resist mechanical adhesion of coatings that are foreign to the alloy. The medium of resistance is a thin, invisible oxide film on the surface of the metal, and the stability of this film is a measure of the corrosion resistance of the alloy. These protective films can be destroyed by chemical, electrochemical, and mechanical means, but they rapidly form again on exposure to air or other oxidizing media. It is this phenomenon that makes surface preparation for application of coatings on stainless steels so difficult.

In promoting a color change in the surface appearance of stainless steels, a method by which this protective film could be ignored would appear to be the simplest and most practical approach to attainment. This would limit the method to electrochemical or chemical means. The protective film would probably exert some influence over the reaction rate in the beginning, but under properly controlled conditions the chemical change could be directed to completion or be made to proceed until stifled by the reaction product. The characteristics of the reaction product in a chemical change of this kind would be of great importance, especially from the standpoint of corrosion resistance.

As an example of an oxide coating having inferior protective properties, consider heating a piece of stainless steel at a sufficiently elevated temperature and in the presence of oxidizing atmospheres. It would not be difficult to effect a color change in the surface appearance of the alloy, the protective oxide film would undergo a chemical change without any apparent difficulty;

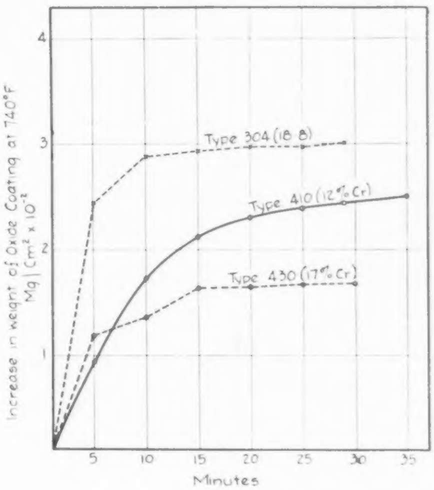


Fig. 1

and, if heating were continued for a sufficient length of time, the chemical reaction would go to completion, at which time the metal would have changed completely into its oxides. If, instead of permitting the chemical reaction to proceed to completion, the steel was heated for a predetermined length of time and then removed from its heating environment, the depth of the oxide coating and the color change could be controlled. However, the reaction product formed under these conditions has been found to be porous, brittle, and can be readily penetrated by various corrosive media. It is obvious that a coating of this type would not afford protection to the underlying metal, and in all probability would prove harmful.

If the reaction product is of such a nature that it forms a thin, continuous, adherent, and strong coating which prevents further chemical action on the metal, then it would be reasonable to expect that this coating possessed inherent protective properties. Black oxide coatings formed on stainless steels in accordance with the method being presented were found to be resistant to further attack on the metal after the comparatively short period of time required for their complete development. These coatings possess considerable strength and elasticity, have good resistance to wear and abrasion, improve the corrosion resistance of the alloy in various corrosive media, and do not impart any dimensional change in the parts treated.

Method and Equipment

Articles to be blackened are first cleaned of scale, grease, oil, or other foreign substances present on the surface. After drying, they are immersed for a sufficient length of time in a molten solution of dichromates[2], preferably sodium dichromate, at a temperature in excess of 615°F. The parts are removed from the solution, allowed to cool, and immersed in warm water. The salts are readily soluble, and no difficulty will be encountered in removing them.

Treatment time will depend on the temperature of the bath, and the size and number of parts being treated. It is recommended that the bath be operated between 730°F. and 750°F, and that the time of immersion be from fifteen to twenty minutes at this temperature. (See Fig. 1).

The only equipment necessary is a steel tank, a sufficient source of heating energy, and work baskets or wires for suspending the parts in the bath. Care must be used to prevent localized heating of the tank. It is recommended that a cover be used, and means be provided for slowly stirring the melt. Neither of these are essential, but they will be found to be consistent with good practice. In blackening small parts in baskets, an occasional shaking of the parts will insure a more uniform finish.

Properties of Coatings

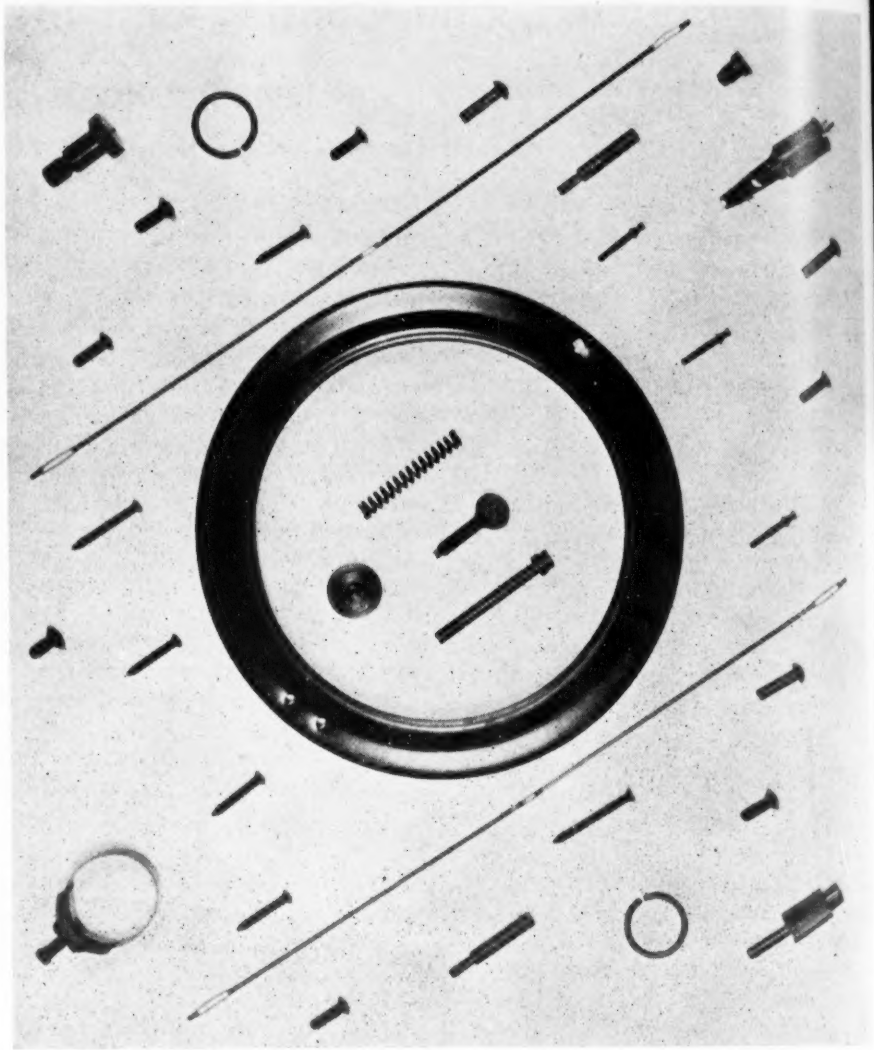
Coatings formed by this process have properties of elasticity and strength that are exceptional. One example of this was revealed when a 50-pound coil of 18-8 stainless steel wire, 0.150" diam. was treated for fifteen minutes in sodium dichromate at 740°F, then lime-coated and drawn in soap through a ten-percent reduction in cross-sectional area.

No visible breaks developed in the black oxide coating during this operation.

Sections of the coil were then bent through a 180° angle flat, and abrasion was applied with a rubber eraser across the more severely bent section. The coating appeared to be sound, showing no tendency to crack or peal.

In general, the coatings show the corrosion-resisting characteristics of the metal's surface prior to coloring. However, the various types of stainless steels after blackening show *improved* resistance to corrosion in various corrosive media (See Table I).

Since these coatings are formed at relatively high temperatures, in a non-aqueous bath, their composition is that of oxides of the metal, and not hydroxides. Consequently, the color is permanent and does not change on exposure to atmospheric conditions. Samples representing the various grades of stainless steel, some of which are shown in Figure 2, have been in the laboratory for more than one year and their color has remained unchanged.



Samples of various grades of stainless steel, some of which have been in the laboratory for more than one year without changing color.

TABLE I—Comparative Corrosion Data in Weak Nitric and Hydrochloric Acids

(Corrosion Rates are expressed as grams/cm²/50 hours.)

*Test Specimens**	0.5% *by wt.* HNO_3*-boiling*	2.5% *by wt.* HNO_3*-boiling*	0.5% *by wt.* *HCl*-120°F.	1% *by wt.* *HCl*-120°F.
12 Cr.	0.0023	0.104	0.993	1.460
12 Cr-Blackened	0.0000	0.008	0.108	0.473
17 Cr.	0.0008	0.0004	2.72	2.940
17 Cr-Blackened	0.000	0.0000	0.0505	0.882
18-8	0.0012	0.0000	0.0193	0.0190
18-8-Blackened	0.0000	0.0000	0.0007	0.0012

* Test specimens were 2" x 1" x .050", with a pickled finish.

Chemical Analysis of Steels Tested:

Identification	*C*	*Mn*	*P*	*S*	*Si*	*Cr*	*Ni*
12 Cr.	.11	.43	.015	.024	.35	12.17	.18
17 Cr.	.10	.47	.018	.017	.36	17.48	.12
18-8	.05	.65	.021	.015	.54	18.11	9.18

Conclusion

Chemical processes generally employed for blackening steels have not proved satisfactory for the stainless steels. A method is presented for surface blackening stainless steels by treatment in molten dichromate at temperatures in excess of 615°F. The resulting black coating possesses a high degree of strength and elasticity, shows good resistance to wear and abrasion, improves the corrosion resistance of the parent metal in various corrosive media, does not produce any dimensional change in the treated part, and the color is permanent.

(1) W. R. Meyer. Proc, A.E.S., pp. 904 (1943).

(2) United States Letters Patent pending

Dyeing Chromic Acid Anodized Aluminum

Colored Finishes

By MARC DARRIN and L. G. TUBBS

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Colored finishes may be readily obtained on chromic acid anodized aluminum and its alloys, in very much the same manner as black finishes. The procedure may be modified to produce almost any desired color. The purpose of this report is to describe how these colored finishes—red, yellow, green, blue—are obtained and the effect of some variations in procedure. It includes results which were obtained with a number of dyes, together with instructions for some typical finishes on commercially pure aluminum and several of its alloys.

The procedure for coloring anodic films is essentially the same as that for black finishes[2] except that some colored films also require a setting operation after removal from the dye bath, in order to improve their fastness to water and light, or to modify their hue. The general operations are:

(1) Cleaning, and etching if required;
(2) Anodizing with subsequent rinsing;
(3) Dyeing followed by rinsing;
(4) Setting or water boil if required.

Cleaning and Etching

Dirt, grease and oil are removed in the customary manner by an alkaline detergent which does not attack the surface of the aluminum or leave a deposit. Care must be taken to completely rinse off any adhering salts or soap before anodizing. Volatile solvents may be employed instead of alkaline detergents.

For gloss finishes the work is anodized after the cleaning operation; however, for some dull finishes and pastel shades it may be necessary first to slightly roughen the surface. This may be done mechanically or by etching in a dilute solution of soda or caustic. Acid etches also may be employed similar to those used for dull black finishes.[2] Parts should not be touched by hand after cleaning, otherwise fingerprints may appear on the finished surface.

The results obtained with high-silicon aluminum alloys are improved by a preliminary hydrofluoric acid etch. Die-castings of alloy ♯13 (12% Si) are being etched at the present time on a production basis by immersion for one to three minutes in a mixture of one part of hydrofluoric acid (48% HF) and eight parts of nitric acid (70% HNO_3). The etched object is rinsed thoroughly before introduction into the anodizing bath.

Anodic Treatment

The ordinary procedure is to anodize at 95°F. for 30 minutes at 40 volts in a chromic acid bath having a concentration of 50 to 100 g./L. total CrO_3 with the pH[3] maintained at about 0.8-0.9 by suitable draw-offs and additions of chromic acid at periodic intervals.[4] Good racking with firm electrical contacts is essential[6] but the voltage is not critical. Since the ordinary anodic film is too thin for the production of deep colors it is desirable to increase the anodizing time or temperature or both. If it does not interfere with other operations, increasing the temperature of the anodizing bath is the more advantageous. Lowering the pH of the bath also increases the thickness of the film but to a lesser degree. Anodizing at 125°F. for 60 minutes produces films which are satisfactory for most dyeing purposes. Anodizing at a higher temperature, or at 125°F. for longer periods of time, seldom improves the film, and may cause a powdery or uneven surface.

Because of the high current density when anodizing silicon-aluminum alloys, and the very high initial current surge, it is advantageous to anodize these alloys at lower voltages or for shorter periods of time. Good results are obtained with alloy ♯13 (12% Si) by anodizing acid-etched die-castings at 30 volts for 30 to 35 minutes at 95°F. in the customary maintained chromic acid bath.

The presence of trivalent chromium in the anodizing bath is unimportant for black finishes and some of the deeper colored shades; however, for yellows and light shades of other colors, trivalent chromium causes the anodic films to be darker and less brilliant when dyed. With a properly controlled anodic bath there should be no difficulty due to trivalent chromium.[5]

Dye Bath

This bath is prepared by dissolving the dye in water, and adjusting the pH, if required, with a small amount of acetic acid. Sometimes the addition of a small amount of sugar appears to make the dyeing more even. The optimum conditions of concentration, temperature, pH and dyeing time are different for various dyes and anodic films. In general the concentration of the dye is from 1 to 5 g./L., and the pH,

* Black finishes appeared in the September 1943 issue of *Metal Finishing*.

from 4 to 8, which seldom means the addition of more than about 1 g./L. of acetic acid. The temperature is from 125°F. to boiling; and the time of immersion in the dye bath, from 15 to 30 minutes.

All adhering chromic acid should be thoroughly washed from the surface with cold or tepid water before dyeing. Boiling water should not be used at this stage as it tends to lower the adsorptive power of the aluminum film. After washing, the objects may be dried or immediately immersed in the dye bath. Results are sometimes a little more uniform if the work is dried before dyeing but this is not essential. After dyeing the work is rinsed in hot water and dried, or the dye may be set.

Setting

Water fastness depends to a large extent on the dye employed; however, some dyes which do not have good resistance may be made water fast by setting with metallic salts. Other dyes may tend to bleed at first, but become set on boiling in water. The general procedure is to immerse in a hot dilute solution of a metallic salt, usually nickel acetate with adjusted pH. Many dyes may be set immediately after dyeing and rinsing, without drying; others give better results if dried before setting. In general the concentration of the setting bath is about 5 g./L. of nickel acetate, the pH, about 5; the temperature, 200 to 210°F.; and the time, 10 to 20 minutes. The pH is adjusted by the addition of a small amount of acetic acid. After setting the object is washed in hot water and dried.

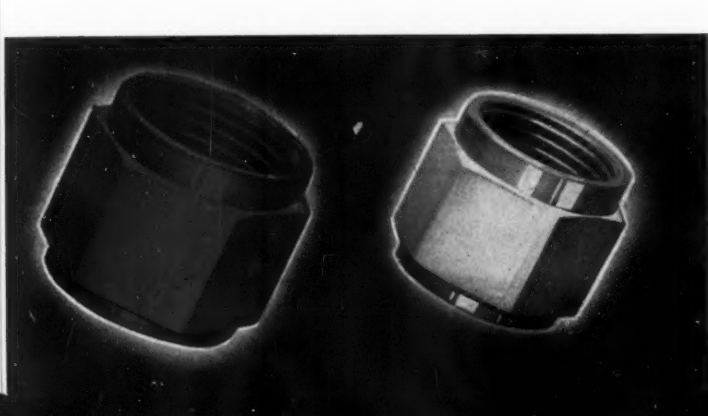
Light fastness, like water fastness, depends chiefly on the nature of the dye. As would be expected, light shades fade more rapidly than deep shades of the same color. Dark violet-reds, pure yellows, dark violet-blues and blacks are more readily obtained in light fast colors than pure blues, greens and yellow-greens.

Properly dyed anodic films have a bright, even gloss, and are non-dusting. Factors which may cause dusting or unevenness are: (1) improper cleaning prior to anodizing; (2) a rough or improperly etched surface; (3) anodizing for too long a time or at too high a temperature; (4) a too concentrated dye bath; (5) improper setting.

Experimental Data

Method: Specimens were cleaned in acetone, anodized in a chromic acid bath under the conditions specified, rinsed thoroughly in tepid water, allowed to air-dry, immersed in the dye bath, rinsed in hot water and dried for 20 minutes at 160°F. Dyed panels which required setting were rinsed and dried in a similar manner after removal from the nickel acetate solution. Baltimore city water was used for all baths.

The anodic baths were thermostatically controlled to ±0.1°F., and provided with adequate mechanical agitation. The anodizing current was obtained from rectifiers, with the voltage manually regulated. Approximately five minutes was allowed to bring to full voltage. The times recorded are for full operating voltage.



Water fastness was tested by boiling for 60 minutes. Mechanical fastness, or dusting, was noted by rubbing with a soft white tissue. Light fastness was determined by the ultraviolet light method. (Ultraviolet light tests were made by E. Johansson of the Young Aniline Works, Baltimore, Md.).

Results obtained with various dyes are shown in Tables I, II, III and IV. All data in these tables were obtained with polished panels of alloy 2S (commercially pure Al[1]) anodized at 125°F. for 60 minutes at 40 volts in a bath containing 100 to 110 g./L. total CrO_3 and little or no trivalent chromium, unless otherwise indicated. The pH of the chromic acid bath is not indicated as it was found to be a minor factor.[2] The procedures shown are illustrative of results which may be obtained with some typical dyes and alloys, and undoubtedly can be refined in plant practice.

Grain Effects

In addition to the results obtained with commercially pure aluminum panels (2S)[1], excellent colors having a high gloss were produced on several other smooth-surface aluminum alloys; however, yellows and light colors were particularly sensitive to the nature of the alloy and the character of the surface. Some manganese-bearing alloys produced an interesting grain effect following the rolling lines of the sheet. The hue and depth of color produced by the same dye bath also was influenced by the alloying elements. Comparison of results obtained with panels of aluminum alloys 3S-½H (1.2% Mn), 24 ST (4.5% Cu, 0.6% Mn, 1.5% Mg) and 52S-¼H (2.5% Mg, 0.25% Cr) are shown in Table V. These panels were anodized at 40 volts for 60 minutes in the usual chromic acid bath at 125°F. The yellow samples were colored in a bath containing 5 g./L. of Aluminum Yellow A, for 30 minutes at 200°F. The green samples were immersed in a bath containing 1 g./L. of Alizarine Cyanine Green GHN plus 0.5 g./L. of acetic acid, for 15 minutes at 212°F. Similar results were obtained with panels anodized for 90 minutes, except that there was less difference between the colors produced on the different alloys. Highly polished panels of the same alloys showed the same rolling lines, on anodizing and dyeing. For purpose of comparison results are included for the same three alloys using a black dye bath.[2] By minor variations attractive finishes were obtained with stampings, forgings, extrusions or castings of aluminum alloys 2S, 3S, 17ST, 24ST, 52S, #13, #85 and on Alclad[1] surfaces.

Literature Cited

(1) Aluminum Company of America, "Alcoa Aluminum and Its Alloys" (1942).

(2) Darrin, Marc, and Tubbs, L. G., Metal Finishing, *41*, 550-4 (1943).

(3) Hartford, W. H., Ind. Eng. Chem. Anal. Ed., *14*, 174-6 (1942); Ind. Eng. Chem., *34*, 1920-4 (1942); Monthly Rev. A.E.S., *29*, 831-7 (1942).

(4) Mutual Chemical Company of America, "Anodizing Aluminum by the Chromic Acid Process" (1942).

(5) Tarr, O. F., Darrin, Marc, and Tubbs, L. G., Ind. Eng. Chem., *33*, 1575-80 (1941); Metal Finishing, *40*, 106-11 (1942).

(6) Tubbs, L. G., Proc. 30th Ann. Conv. Am. Electroplaters' Soc., pp. 121-34 (June 1942).

TABLE I. Grain and Color Effects Caused by Alloying Constituents

Yellow Dye Bath

3S½H	green color, with an attractive grain effect
24ST	greenish yellow color, with a grain effect
52S¼H	golden yellow color, uniform with no grain

Green Dye Bath

3S½H	deep blue-green color
24ST	deep green color
52S¼H	medium blue-green color

Black Dye Bath[2]

3S½H	good black, with grain effect
24ST	good black, with grain effect
52S¼H	good black, uniform with no grain

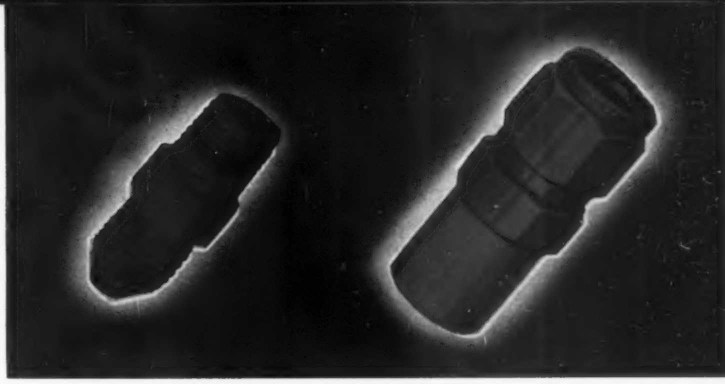


TABLE II. Results Obtained With Yellow Dyes

(In order of increasing green hue)

	Dyeing Operation				*Properties of Dyed Panels*								
	Conc. g./L.	*pH*	*Temp. °F.*	*Time min.*	*Set*	*Hue*	*Color Depth*	*Bright-ness*	*Water Fastness*	*Light Fastness—hours* 20	55	90	110
Solatine (a)	5	8.1	180	30	set	orange	deep	bright	good	good	good	fair	fair
Wool Yellow (b)	5	6.8	180	30	none	yellow	med.	bright	good	good	good	fair	fair
Quinoline (c)	1	8.1	180	30	none	green-yellow	light	bright	good	good	good	good	....
Al Yellow (d)	5	5.7	200	30	set	green-yellow	light	med.	good	good	fair	fair	fair

(a) *Solatine Yellow FF Conc.:* required no adjustment of pH; critical as to temperature; at 125°F. film light yellow, without orange hue, but color tended to be uneven; increasing temperature, increased orange hue; increasing immersion to 60 min., improved evenness, shortening to 15 min. had reverse effect; reducing concentration lessened orange hue; fairly good water fastness without setting, but improved by this treatment; further improved by 60-min. water boil, with or without nickel acetate set.

(b) *Wool Yellow Extra:* required no adjustment of pH; lower temperature less satisfactory; varying time from 15 to 60 min. had little effect; water fastness improved by nickel acetate set.

(c) *Quinoline Yellow P:* uneven color when dying conditions varied; used without adjusting pH; lowering pH caused unevenness and dusting; increasing concentration produced uneven orange hue; water resistance improved by nickel acetate set.

(d) *Aluminum Yellow A:* required no adjustment of pH; concentration not critical; less satisfactory below 175°F.; fairly water fast without setting, but improved by nickel acetate treatment, and further improved by 60-min. water boil.

TABLE III. Results Obtained With Green Dyes

(In order of increasing blue hue)

	Dyeing Operation					*Properties of Dyed Panels*								
	Anodiz-ing min.	*Conc. g./L.*	*pH*	*Temp. °F.*	*Time min.*	*Set*	*Hue*	*Color Depth*	*bright-ness*	*Water Fastness*	*Light Fastness—hours* 20	55	90	110
Naphthol Green (a)	60	5	3.7	180	30	set	yellow-green	med.	bright	fair	poor	poor	bad	bad
Direct Erie (b)	30	5	8.8	180	20	set	yellow-green	deep	med.	good	poor	bad	bad	bad
Mixed Dye (c)	60	5	4.2	180	30	none	green	deep	bright	good	good	good	good	....
Light Green (d)	60	5	3.4	200	30	none	green	dark	fair	bad	bad	bad	bad	bad
Naphthaline (e)	60	5	6.4	210	15	none	green	med.	med.	fair	bad	bad	bad	bad
Palatine (f)	60	5	3.7	210	30	set	blue-green	deep	fair	good	poor	bad	bad	bad
Alizarine (g)	30	1	3.7	210	15	none	blue-green	deep	bright	fair	good	good	fair	fair
"	60	1	3.7	210	30	set	blue-green	deep	bright	good	good	fair	fair	fair
"	60	1	3.7	210	45	set	blue-green	very deep	bright	good	good	good	good	fair

(a) *Naphthol Green B:* dyed unevenly at higher pH; almost no water fastness before setting; dyeing at 200°F. increased water resistance, but produced bluer hue; panels anodized 120 min. brilliant yellow-green, but dusted on rubbing; anodized 30 min., light grayish green.

(b) *Direct Erie Green GY:* required no adjustment of pH; lower temperature caused uneven color; almost no water resistance before setting, which was at pH 4.2; higher pH less satisfactory; color very dark, when anodized 60 min.

(c) *One part Pontamine Fast Turquoise 8GL conc. 150%, two parts Quinoline Yellow P Extra conc.:* dyeing 15 min. produced lighter yellower green; 60 min. very much darger green; water fastness improved by nickel acetate set.

(d) *Light Green SFA conc.:* required no adjustment of pH; almost no resistance to water, hot or cold; did not respond to setting with nickel acetate (or other chemicals) at various pH, temperature, concentration.

(e) *Naphthaline Green V Extra conc.:* no adjustment of pH; setting caused unevenness unless pH lowered to about 4.2, and time to 5-10 min.; water fastness improved by 60-min. water boil without nickel acetate set, but this lightened color; dyeing at lower temperature decreased water resistance.

(f) *Palatine Green BLNA conc. CF:* required adjustment of pH; water resistance quite good without setting, but improved by nickel acetate treatment; when pH was not adjusted, color lacked water fastness and was lighter and bluer.

(g) *Alizarine Cyanine Green GHN extra:* required adjustment of pH, and a dilute, almost boiling bath, and filtering from time to time; otherwise color was uneven; decidedly blue before setting; greener after setting; pH of setting bath adjusted to about 5.3 to prevent bleeding; this pH caused gray film which was wiped off, or removed by boiling in dilute acetic acid. In general the use of this dye was critical; unsatisfactory results obtained with other Alizarine Cyanine Greens, namely G conc., G Extra New and EF New.

TABLE IV. Results Obtained With Blue and Black Dyes

(In order of increasing violet hue)

	Dyeing Operation						*Properties of Dyed Panels*								
	Anodizing min.	*Conc. g./L.*	*pH*	*Temp. °F.*	*Time min.*	*Set*	*Hue*	*Color Depth*	*Brightness*	*Water Fastness*	*Light Fastness—hours* 20	55	90	110
Pontamine (a)	60	5	4.6*	180	30	set	blue	deep	very bright	good	good	good	good	
Al Blue (b)	60	5	8.4	150	30	set	blue	deep	bright	good	fair	fair	fair	fair
Niagara Sky (c)	60	5	5.1	180	30	set	violet blue	very deep	very bright	good	good	good	fair	fair
Niagara Direct (d)	30	1	4.2	180	30	set	black	very deep	very bright	good	....	....	....	
Nigrosine (e)	60	5	7.0	180	30	none	black	deep	very bright	good	good	good	good	good

(a) *Pontamine Fast Turquoise Blue 8GL:* used with adjusted pH; unsatisfactory at higher pH; water fast without setting, but brightness and blue hue improved by nickel acetate set, or 60-min. water boil, or both; if not set, or boiled, color has green hue; good results also with baths containing 2.5 gpl dye; also with samples anodized at 95°F. for 30 or 60 min.

(b) *Aluminum Blue A:* required no adjustment of pH; similar results on dyeing 15 to 60 min. also with dye concentrations 2.5 to 5.0 gpl; at higher concentration shades were only a little darker; quite water fast without setting, but improved by nickel acetate treatment, with or without 60-min. water boil.

(c) *Niagara Sky Blue 6B:* used with adjusted pH; quite water fast without setting, but improved by nickel acetate treatment, with or without 60-min. water boil.

(d) *Niagara Direct Blue RW:* used with adjusted pH; bled at first but water fast after 60-min. water boil, or after nickel acetate set.

(e) *Nigrosine JB:* used without adjustment of pH; lowering increased bluish tone; if desired this may be masked by Metanil Yellow, up to 15-20% of the Nigrosine. For additional details regarding use of Nigrosine see *Metal Finishing, 41*, 550-4 (Sept. 1943).

TABLE V. Results Obtained With Red Dyes

(In order of increasing orange hue)

	Dyeing Operation					*Properties of Dyed Panels*							
	Conc. g./L.	*pH*	*Temp. °F.*	*Time min.*	*Set*	*Hue*	*Color Depth*	*Brightness*	*Water Fastness*	*Light Fastness—hours* 20	55	90	110
Guinea Red (a)	5	4.7	180	30	set	violet-red	very deep	bright	good	good	fair	poor	bad
Azorubine (b)	5	7.5	180	30	set	red	deep	very bright	good	good	fair	fair	fair
Direct Fast (c)	1	7.2	140	15	set	red	deep	bright	good	poor	poor	poor	poor
Neolan Red (d)	5	3.8	180	180	none	red	med.	med.	fair	fair	fair	fair	fair
"	5	3.8	180	180	set	orange-red	med.	med.	good	poor	poor	poor	poor

(a) *Guinea Red GL:* used with adjusted pH; fair water fastness but improved by set.
(b) *Azorubine Extra:* not critical of pH or other variations in dyeing; almost no water fastness before setting.
(c) *Direct Fast Red 8BLA conc.:* used without adjusting pH; almost no water fastness before setting.
(d) *Neolan Red BRE: very slow in combining* with alumina film; used without adjusting pH; raising pH produced less satisfactory results.

The Nature of Foreign Deposits on Metal Surfaces

By P. D. LIDDIARD, B.Sc., A.I.C.

Assistant Director of Technical Research, B.H. Chemicals, Limited

CAREFUL study has endorsed the opinion that many deposits form close physical attractions for metal surfaces and a knowledge of the type of attraction involved would obviously be useful in deciding the course to be pursued in freeing the metal from these deposits.

This study is begun with an examination of the states in which deposits can occur. Basically any deposits can exist on a metal surface in one or more of three phases, namely, solid, liquid or gaseous. These deposits may be continuous or broken in varying degrees.

Deposits in the Solid Phase

Solids can be present either in an amorphous or a crystalline form. The particle size can vary over the range from that of molecular dimensions, through colloids, to particles of visible size. Molecular particles may exist in a simple phase being adsorbed to the metal surface. Consideration will be given to the state of adsorption at a later stage in this paper.

When associated with a liquid phase, solid colloidal particles may be in a suspensoid form; or, when the liquid phase is prominent in a colloidal structure, in jelly form. An example of the latter condition is to be seen in a film of partially dehydrated soap.

Larger solid masses may be directly associated with the metal surface in one of three ways:—

(1) Direct chemical combination, by molecular attraction. This brings about strong linkage between the metal molecules and those of a foreign substance, as, for example, in the formation of a metal sulphide or oxide layer on the surface.

(2) Alloying, in which the metal surface molecules mix in solid solution with those of an alloying material. The molecular attractive forces are far less apparent than in chemical combination, and the result is more of a physical mixture. The alloying material is usually a metal, as for example, a solder upon the surface; but non-metallic materials such as carbides may also form such a physical mixture with the surface molecules.

(3) Macro-adsorption, in which larger groupings of molecules (known as micelles) can take on an electric charge, and when such a charge is opposite to that of the exposed metal surface molecules, these micelles arrange themselves along the surface at a given distance from it, this distance depending upon the extent of the charge. The charge will, of course, be distributed over the surface of the micelles and the larger the surface area the less the charge per unit area. Hence the larger the particles for a given charge the less the attractive force acting towards the metal molecules. An example of this condition is to be seen with colloidal carbon particles which often prove extremely difficult to remove from a metal surface for this reason. Larger solid particles are usually separated from the metal surface molecules by other deposits, such as solids of the three types mentioned above, or a liquid phase, or even a gaseous phase.

Deposits in the Liquid Phase

Obviously the liquid phase may be present in the form of a pure liquid or of a solution. Where two or more liquids are present they may be in the form of an emulsion. As already stated the liquid may be associated with a solid producing a suspension or a gel. The liquid may also be associated with a gas as a stable foam.

Pure liquids and solutions display surface active properties. These properties are not so apparent in solids although they do exist. One of these properties is that of surface tension, and when this latter is high between the liquid surface and that of the metal, then such a liquid does not readily cover the surface of the metal. If the tension is lowered, as, for example, by the addition of surface active materials such as soaps, polyglycerol esters, etc., to water, or metallic soaps to oil, the liquid will spread or "wet" the metal surfaces more readily and can form a continuous film over it; or it can spread over other deposits provided that these latter do not exert a high surface tension with the liquid. It can be stated that if the interfacial tension between two materials is lower than that between one of the materials and a third material, then the first two will complete their surface contact, displacing the third. The third material may be gaseous, liquid or solid. Examples of such displacement are those of air being displayed by an advancing soap solution on a metal surface; and of water from a surface by some mineral oils. These latter usually have lower surface tensions than that of water.

TABLE I

CONTACT ANGLES OF METALS

		Contact Angle	
Metal	*Condition*	*Water*	*Oil*
Aluminum	Polished	43°	Less than 5°
Aluminum	Unpolished	57.5°	Less than 5°
Brass 70/30	Polished	55°	15°
Brass 70/30	Unpolished	68°	About 15°
Cadmium	Polished	76°	About 10°
Cadmium	Unpolished	76°	About 10°
Chromium	Polished	40°	Less than 5°
Chromium	Unpolished	65°	Less than 5°
Copper	Polished	65°	11°
Copper	Unpolished	65°	11°
Mild Steel	Polished	65.5°	15°
Mild Steel	Unpolished	25°	7°
Nickel	Polished	60°	Less than 5°
Nickel	Unpolished	65°	Less than 5°
Tin	Polished	31°	Less than 5°
Tin	Unpolished	33°	Less than 5°
Zinc	Polished	30°	Less than 5°
Zinc	Unpolished	31°	Less than 5°

In Table I, some of the contact angles between water and a metal surface, and between oil and a metal surface are shown. In each case figures are given for the polished and the unpolished condition of the metal. The extent of polishing varied in all cases and was merely examined to show that there is a difference in many cases (but not all) where the metal has a more regular surface.

It will be seen that in all cases except that of mild steel, the value for the unpolished metal is either the same or greater than that for the polished metal. The case of mild steel is surprising, and is also to be noticed where oil is used as well as with water.

The experiments were in all cases repeated to obtain duplicate values, and particular attention was paid to the anomalous case of mild steel.

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The values for oil in contact with the metal are always far lower than those for water, and it would seem that the degree of wetting in the case of the oil and the metal is greater than that of water. It is to be expected (although this is not certain) that the degree of adsorption will also be greater in the former case.

In view of the rather low values obtained with the oil it was found difficult in the apparatus used to obtain absolutely correct readings, but they are sufficient to show the difference. The oil used was a light aliphatic hydrocarbon mineral oil, and the water used was distilled.

Deposits in the Gaseous Phase

At first the gaseous condition might not be considered as being of great importance in deposits on metal surfaces, but such a phase can and frequently does exist and may even be the source of problems in metal treatment.

A simple example is that of air which may remain undisplaced by a liquid phase and may prevent access of that liquid phase to the metal surface, particularly in pores and narrow cracks which act as capillaries. The gaseous phase is more apparent when dry solid deposits are present, particularly if these are granular. Water vapor, being a gaseous phase, must also be considered under this heading. More usually these gaseous layers are present as adsorbed films on clean metal surfaces.

Adsorbed Layers

The surface molecules on a metal exert forces on molecules of whatever other matter is near them. These forces are mutually satisfied in the body of the metal itself but are not satisfied at the metal surface. They are apparent as surface active effects; for example, as surface and interfacial tensions, and as adsorption. These molecular forces can attract or repel other foreign molecules to a given distance, this being governed by the inter- and intra-molecular forces operating and apparent in the distribution of the charges on the molecules. The metal surface can never be free from foreign molecules of some sort, for these forces must be satisfied. They may be merely satisfied by molecules of a gaseous material, as, for example, oxygen, carbon dioxide, nitrogen, etc.

The adsorbed materials will be in a molecular form and not atomic. If they were in the latter condition chemical combination with the metal atoms would occur to give compounds. This is prevented by the stronger forces of combination existing between the atoms in the gaseous molecule itself; for example, there is usually a greater combining force between two nitrogen atoms than between a nitrogen atom and a metal atom. In the case of many of these gaseous products the lack of other gas molecules sufficiently near to give other attractive forces means that the adsorbed gas is easily displaced by a denser medium, such as a liquid. When liquid adsorption occurs at a metal to liquid interface it may be very strong. Adsorption is not so apparent between solids since the restriction of movement of the molecules in a solid does not allow the molecules to take up mutual positions with relation to the metal surface molecules. Then again, surface molecules of solids have in most cases already an adsorbed layer of some other material, either liquid or gas, which acts as a buffer.

Kinetic Considerations

Examination of surfaces in this light must raise considerations of the proximity of molecules to each other, either within a substance or between two substances. According to the kinetic theory of matter the greater the distance apart of the molecules from one another the less dense is the medium, and this determines whether the material is in the gaseous, liquid or solid phase. Free movement of the metal molecules is restricted, although, of course, there is some movement, depending largely upon the temperature. Very few molecules will leave the general surface, however. The adsorbed layers will be fairly static whatever their phase, this being due to the intermolecular forces. The adsorbed layers will act as buffers between metal surface molecules and the rest of the media in the deposit. According to the temperature so the extent and rate of movement of the molecules in the various phases of the deposit will vary and with these their mutual distances. Generally the displacement by another medium will be facilitated at elevated temperatures, since the less close the molecules are together the less can be their combined attractive force on the metal surface molecules. Here it is as well to point out that where the medium used for cleaning, i.e., that which is to displace the foreign medium, contains particles of dimensions larger than molecclar size, the force which these particles will exert when coming sufficiently near to those of the molecules of the deposit, will be dependent upon the mass and the velocity of these particles. The velocity increases with rise in temperature. The effect of the mass indicates the advantage of colloidal particles in the cleaning medium rather than a simple solution.

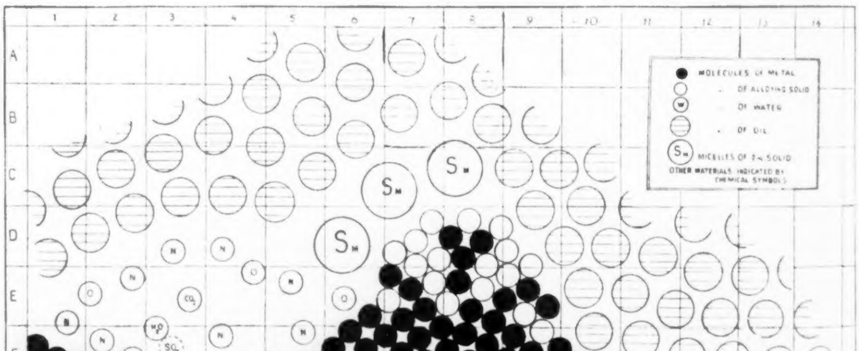


Fig. 1. Diagrammatic representation of conditions existing at a metal surface.

Diagrammatic Representation

The diagram, Fig. 1, shows in a pseudo-molecular form the states of matter which might exist in a mixed deposit on a metal surface. All conditions are not shown; for example, aqueous and oleiferous solutions and emulsions are omitted in order not to complicate the picture. The whole representation is very diagrammatic and no attempt has been made to show molecular dimensions or distances. There has been some attempt to indicate that oil molecules are larger than those of water, the gases, or metals; and that the solid micelles are larger still. Again there has been an attempt to indicate the more compact nature of the metal molecules and the more rarefied and more irregular distribution of the gaseous molecules, but beyond these vague indications the diagram must not be taken as specifically indicating sizes and distances.

Considering the metal surface molecules on the left-hand side of the diagram, a pocket of trapped air is indicated. This contains molecules of nitrogen, oxygen, carbon dioxide, etc., some of these molecules forming a mixed regular adsorbed layer. The remaining molecules are irregularly scattered, being in a constant state of movement fairly far apart from each other and exerting little influence upon each other or upon the metal surface. There is a possibility of some adsorption at the oil-air interface, and this might mean a more regular and fixed layer in this region.

Oil is the general deposit over the metal surface, but a trapped water pocket is indicated on the right-hand side of the diagram. Again there is adsorption at the metal surface and the activity of the molecules at the oil-water interface is indicated by mutual repulsion. In view of the lower surface tensions of oils in general, compared with that of water, it is to be expected that the forces of adsorption between the oil and the metal will be greater than that between the water and the metal.

Three systems of solid deposit are indicated. In the air pocket (F. 3) a sulphur dioxide molecule has been shown. This would become attracted to the metal molecules and in the presence of moisture would probably combine with the metal molecules at the surface, giving a sulphide molecule. This is direct chemical combination with little hindrance from other molecules. The resulting compound is stable and neutral in charge. In the area D.7, 8, 9; E.7, 8, 9, alloying of some other solid with the metal is indicated. Mixing of the molecules, not a combination, but a physical solution occurs; this solid solution is shown in the irregular mixing of the metal and the alloying solid molecules. Outside this area, in the regions D.6, C.7, C.8, three larger bodies are seen, representing charged molecular agglomerations. These micelles are charged oppositely to the metal molecules and are held close to them in the manner shown.

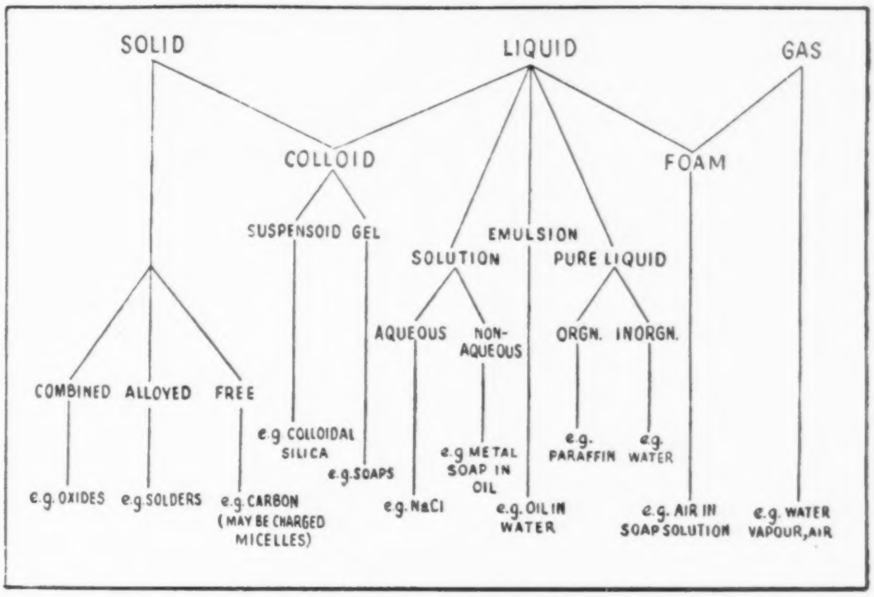


Fig. 2. Classification of possible deposits on a metal surface.

A classification of the more general deposits under this scheme can be attempted, and it has an important bearing upon the methods to be employed for their removal. Fig. 2 is a diagrammatic indication of such a classification, one which is fairly comprehensive for these general deposits.

Removal of Solids

Considering first the combined deposits such as the metal sulphide molecule, it is possible to rupture the combined grouping by chemical means, as, for example, pickling to remove sulphides and oxides, or the use of alkali solutions to remove zinc oxide by the formation of the soluble sodium zincate. The deposit formed may itself be chemically soluble, as, for example, some metallic chlorides in water. On the whole, purely physical forces cannot completely remove such deposits, except by the extreme of abrasion. Occasionally powerful jetting will remove much of the deposit, but it cannot be fully successful unless some form of solution is practiced as well. Similarly with the alloyed deposits where, although the adhesion is more physical than chemical, the ease of removal is often difficult. Solders may require dissolution in acids or alkalis or the application of heat.

The free solid deposits are more easily removed by physical forces. Charged micelles may prove difficult and are rarely removed by simple immersion treatment. Strongly surface active detergents and solvents are of little use, since the charge must be broken down before removal can be accomplished. This can be done by the physical effect of jetting and is particularly effective if particles of colloidal dimensions are present in the detergent solution. With other solid matter of macroscopic dimensions the presence of adsorbed layers of secondary materials on their particles usually renders them fairly easy to remove, such ease of removal being determined by the breakdown of surface active forces between the secondary adsorbed material and the metal. Good surface-tension-reducing agents in the degreasing solution will usually perform this.

(Concluded on page 166)

THIS IS WASHINGTON—

By George W. Grupp
METAL FINISHING'S Washington Correspondent

Razors and Razor Blades Coming Back On January 4, 1944, the WPB revoked Order L-72, which restricted the production of razors and razor blades. The production of razors and razor blades in 1944 will be limited only by the amount of materials that can be allocated for the purpose under Controlled Materials Plan or are available outside CMP regulations.

Tin Remains on Critical List The Office of War Information started something when on January 7, 1944, it announced that "(1) Bauxite—aluminum ore—will have been cut back by about 40 per cent by the end of January. Primary aluminum production will probably be curtailed nearly as much within the next few weeks. (3) Copper, magnesium, zinc, and molybdenum, desperately short only six months ago, are now fairly plentiful. (3) Practically all other metals, including tin, are expected to come off the critical list—barring unforseen developments—during 1944." This later statement concerning tin aroused the ire of Erwin Vogelsang, WPB director of the Tin and Lead Division. He denounced the tin statement by saying that it was "as wrong as anything the OWI ever said." Then he added: "There is not a chance of the tin stockpile ever being increased while the Japs are in the Dutch East Indies. Tin will be needed as much in 1944—and 1945—as it was in 1939."

War Manpower Commission Helping SWPC The War Manpower Commission announced on January 13, 1944, that it has called on its Regional Directors to assist the Smaller War Plants Corporation in stimulating the letting of subcontracts. Members of the metal finishing industries who can take on additional work should get in touch with the local War Manpower Commission's office.

Leaves WPB William W. McCord has resigned as Chief of the Electroplating and Anodizing Equipment Section of the General Industrial Equipment Division of the War Production Board to become sales manager of the Chandeysson Electric Company of St. Louis. When Bill drank beer at Old Nassau, was coxswain of the crew, and listened to Professor Woodrow Wilson lecture, little did he realize that he would be an important figure in the metal finishing industry and become the inventor of (a) a method of and apparatus for producing copper sheets electrolytically, (b) an agitating means for electrodepositing apparatus, (c) an electroplating method and several depositing apparatus, and (d) a machine for making of heat transfer devices. Bill, who was born in Chicago in 1887 began his business career, after graduation from Princeton in 1910, as the purchasing agent for the Vacuum Insulating Company of Chicago. When he left this firm he began his thirty years' association with the McCord Radiator and Manufacturing Company of Detroit where he served in various capacities such as production manager, brass foundry manager, electroplating manager, and research engineer. McCord, who is one of the pioneers of chromium plating, was one-time national chairman of the electrodeposition division and a member of the publications committee of The Electrochemical Society. He has served as president, and as a member of the Board of Managers, of the Detroit Branch of the AES. He was formerly a member of the Research Committee and also was one-time associate editor of the AES's Review, and general chairman of the 1934 convention of the AES. When the WPB asked Dr. William Blum to secure for them a man who knew the electroplating business, the services of Bill were secured as an industrial specialist. That was in November, 1941. Three months later he was made chief of an electroplating unit. In July, 1942, he was made a section chief in the Consumers Goods Division. This section was later transferred to the General Industrial Equipment Division. And from October, 1942, until his resignation, he served his country well as chief of the Electroplating and Anodizing Section. Everyone wishes Bill McCord good luck in his new job.

Post-War Metal Finishing Equipment Market The mechanical appliances of the metal finishing industry such as abrasive blasting equipment, electroplating and galvanizing apparatus, generators, and other devices are being worked over-time to help win the war. Naturally, this condition is increasing the rate of mechanical fatigue—so much so that a lot of metal finishing equipment will have to be replaced because it will be worn out or obsolete when the warring nations lay down their arms to again devote themselves to peaceful occupations.

Current Ratio Equipment Sales Obstacles When this post-war period is ushered in many metal finishing establishments may find themselves without sufficient liquid assets to buy the needed equipment; and some equipment manufacturers may be unwilling, or unable, to finance potential buyers of their equipment because of their low current ratio. For example, in making an analysis of the balance sheets of 30 companies the writer found that all of the ratios of current assets to current liabilities of these firms in 1942 were less than in 1939. Most of them had a current ratio of less than 2.00. The current ratio of one company dropped from 12.53 in 1939 to 1.69 in 1942. The low current ratio of this and other companies, due to over-expansion of facilities to produce the needed materials for our fleets and armies, and due to high taxes, will cause a serious post-war marketing problem for metal finishing equipment manufacturers.

How to Finance Post-War Electroplating Equipment Sales One might now ask: How should equipment manufacturers finance their post-war sales to keep their factories busy? Where will metal finishers find the money to buy the equipment they need? The answer to both of these questions is liberal selling terms—the installment payment sales plan. Space will not permit a presentation of the many economic advantages of such a plan to both the manufacturers and the metal finishing establishments. For this reason, all comments must be limited to the statement that since manufacturers prefer to devote their time to producing and selling their equipment and be relieved of the task of collecting installment payments from metal finishers, therefore in a liberal selling terms campaign it is necessary to engage the services of a substantial finance company with offices throughout the United States like the Commercial Credit Company of Baltimore, Maryland. A finance company of this caliber will tailor its services to suit the particular needs of an individual manufacturer. Companies with enough vision to market their metal finishing equipment on an installment payment plan with the services of a strong finance company get at once their moneys due from the sale of their equipment; and, they help metal finishers to pay for their equipment out of earnings from usage.

Baltimore-Washington Branch Banquet The annual educational session, banquet, floor show, and dance of the Baltimore-Washington Branch of the AES, which was held at the Lee Sheraton Hotel in Washington on February 5, 1944, was a great success. Dr. V. A. Lamb presided over the educational session which was graced by three speakers, Dr. C. L. Faust, Ovide G. Hogaboom, and Frank K. Savage, who illustrated their talks with lantern slides, motion pictures, and blackboard sketches. Genial Samuel R. Warnock, the branch president, was on hand in spite of a severe cold. He provided the members with a big laugh when he asked them to vote on a motion. The motion was met with the silence of the grave. This was followed by the banquet, floor show and dance which was attended by about 100 members and guests. Thomas Slattery, who acted as master of ceremonies of the floor show presented by the students of the Hayden Studio, concluded the show with a number of fine vocal solos. Dr. William Blum was on hand to lend dignity to the evening; and Dr. Abner Brenner kept himself busy collecting money for tickets.

Faust Talks on Electropolishing At the educational session Dr. C. L. Faust, electrochemist of the Battelle Memorial Institute, presented a paper on "Electropolishing and Some of its Applications" illustrated with about 60 lantern slides. Dr. Faust, who has done considerable research work in this field, opened his presentation by stating that scientists and industrialists have been working secretly for some time on electropolishing as a new tool—a tool which results in a more brilliant finish. By means of slides he demonstrated how metals are dissolved uniformally by electropolishing. He spoke of its possibilities to decrease costs; he reflected on its opportunities; and he stated that metals finished by electropolishing have a more permanent polish. But in making these claims he was cautious, for he said that electropolishing will not and does not supplant wheel polishing. In concluding his paper he showed some interesting graphic chart slides on such themes as (1) the effect of sulfuric-phosphoric acid polishing bath on different kinds of stainless steel, (2) the current efficiency of electropolishing with different current densities, and (3) the viscosity changes in baths during electropolishing without acid or water.

Hogaboom Delivers Talk on Plating Ovide G. Hogaboom, foreman plater of the New Britain Machine Company, delivered himself of a very practical talk, illustrated with about 12 lantern slides. His theme was announced as "Industrial Salvage by Electroposition." He opened his remarks with the wise slogan of "Save your scrap to win a scrap." After describing various bath solutions for decorative purposes he stated that salvaging is largely a matter of correct racking. Then he described, with the aid of lantern slides how to easily and correctly rack different kinds of objects with hooks, split rings, rubber stoppers, bolts and nuts, washers and wooden plugs. With a sketch he illustrated how to plate objects larger than the shop's tanks. He showed how to use a "tooter," "octopus" anodes, and a host of other things. This talk was something which every plater present enjoyed because it was something practical and something he could put to use the next day. It was the practical talk of the evening.

Savage Thrills Audience With Color Films "A Preliminary Study of Electrode Mechanics by Color Photography" was the theme of the paper presented by Frank K. Savage, general superintendent of C. G. Conn, Ltd. The first portion of his paper was given over to a discussion on electroforming and some of the pitfalls one encounters in this process. Electroforming, he said, is more than heavy electroplating for it is from 20 to 200 times thicker. A different thought process is necessary in electroforming because the problems are much different than those of normal plating. In discussing the materials and apparatus necessary in this process he cautioned his auditors against underestimating capital requirements for experimental purposes. He described the problems of dirt and porosity and anode difficulties in the making of cornets, trombones, kettle-drums and other metal musical instruments by the electroforming process. He topped off his paper with an instructive motion picture film in color of corrosion and electroforming.

Users of Metal Cautioned Walter Janssen, chief of the Metals and Minerals Unit of the Department of Commerce, cautions users of metals that the present surplus stocks do not necessarily mean an abundance is available for the production of civilian goods. Mr. Janssen suggests that the industrialists' wish to take advantage of the opportunity to start civilian production may not be matched by an equal desire on the part of consumers to buy now.

Anti-Accident Agreement On January 26, 1944, an operating agreement was entered into by the War Production Board and the Department of Labor for the purpose of pooling certain of their forces to reduce the toll of industrial accidents. This agreement provides that the Safety and Health Branch of the Labor Department's Division of Labor, among other things will analyze and serve as a central clearing house for information on safety laws, regulations and their administration; and that it shall prepare and publish pamphlets and other literature on industrial health and safety.

Cadmium Allocation Procedure Simplified General Preference Order M-65 as amended on January 22, 1944, revised the procedure for allocating cadmium and for controlling the use of cadmium products. This amended order describes the permitted uses for cadmium and cadmium products in broad general terms rather than prohibiting use for specific items. The amended order frees persons using 100 pounds or less of cadmium per month from filing requests with WPB.

Cadmium Order Error Corrected To correct an error General Preference Order M-65 was amended on January 31, 1944. In the January 22, 1944, amended version of the Order the word "no" was omitted in paragraph 6 under Section "C". This paragraph as corrected now reads: "(6) For the manufacture of a lead base alloy containing no more than 3% by weight of cadmium for the coating of copper wire."

Chromium Chemical Expansion Discussed The WPB's Primary Chromium Chemicals Industry Advisory Committee which met in Washington on January 20, 1944, discussed the possibilities of increasing the production of critically needed chromium chemicals by using existing facilities more efficiently and by expansion of facilities. As a result, a task group was named to study the various problems of increased production, manpower and costs.

CMP Procedure Simplified The WPB issued Direction No. 1 to Priorities Regulation 11-B on February 10, 1944, for the purpose of simplifying the procedure under which manufacturers of one product, part of the output of which are Class B products and the rest of which are unclassified products, may file a single Controlled Materials Plan 4-B application to cover the entire production of the item. Unclassified products are those that do not contain controlled materials forms or shapes of copper, aluminum, or steel. For example, he may file a single CMP-4B application for the entire production of abrasive wheels, or, if he prefers, he may file (1) a CMP-4B application covering the wheels that are Class B products and (2) a WPB-2613 for the wheels that are unclassified products.

Contract Termination Data to be Compiled

On February 1, 1944, the WPB issued General Administrative Order No. 2-139 to instruct WPB personnel on the recording and distributing information on contract termination and procurement program adjustments. The tabulation will be conducted by the Bureau of Planning and Statistics. Their compilation will show the resources made available as a result of modifications in procurement programs resulting from changes in military requirements. This information will be used in scheduling open facilities for other war contracts and for civilian production of essential goods.

Copper Advisory Committee Meets

At the February 4, 1944, meeting of the WPB's Copper Producers Industry Advisory Committee, Michael Schwarz, director of the WPB Copper Division, told the committee that the nation's copper requirements in 1944 can only be met if industry and labor get together. He told the committee that requirements are barely balanced by the supply based on maximum and uninterrupted production in the mines, in the refineries, and in the brass and wire mills. He pointed out that there can be no relaxation of copper restrictions.

Copper Cents Being Made

During the month of January, 1944, about 170,000,000 copper cents rolled from the mints of the United States. These new cents were made from used small ammunition shell casings collected from rifle ranges and Army camps, and proving grounds. These casings are about 70 per cent copper and 30 per cent zinc. The mint added some pure copper to give the new copper cents the right proportions of metals. None of the 1,093,000,000 steel and zinc cents made last year will be withdrawn from circulation. It is believed, however, that the banks will collect the steel cents and keep them as reserves in event of shortages of copper cents. And thus the pesty steel will make its exit.

Replacement of Material Procedure

On February 8, 1944, Direction No. 7 to Priorities Regulation No. 3 was issued for the purpose of establishing rules governing the replacement of defective material or material which has been lost, stolen, destroyed or damaged in transit. The Direction provides that a supplier must schedule replacement delivery of material on the basis of the original order as follows: "1. If, in the case of defective or damaged material, he is notified within 15 days after the material was delivered, by the person who placed the rated order. 2. If, in the case of material lost, stolen, or destroyed in transit, he is notified by the person who placed the rated order within 45 days of the date the material was shipped."

Report Forms Simplified by OPA

Corporations which make annual and quarterly financial reports to the OPA will be pleased to learn that the forms have been simplified. For example, Form "A" for annual reports has been reduced from 19 to 4 pages.

Sodium Phosphate Order Amended

Allocation Order M-334 as amended February 7, 1944, provides for an increase of the allocation period of sodium phosphate from one to two months with corresponding adjustments in delivery and certification of customer's use. Where, for instance, 1000 pounds would be allocated for March, under the old system, now 2,000 pounds will be allocated for the March-April period.

Abrasive Grain Control Clarified

According to Interpretation No. 2 of Conservation Order M-319, which was issued on February 15, 1944, producers of abrasive grain who also act as distributors of this commodity are permitted to take advantage of the small order certification allowed by the Order to obtain deliveries of grain from other producers for resale to fill small orders without further processing.

New Copper Order Replaces Others

Copper Base and Copper Base Alloys Order M-9-a and Copper Scrap and Copper-Base Alloy Scrap Order M-9-b were revoked on January 19, 1944, and replaced by a new order known as M-9. In addition to this new order the WPB issued Directive 1 for the purpose of preventing the accumulation of needed copper scrap in the hands of scrap dealers and to maintain a steady flow of needed grades of copper where needed. The primary purpose of the new copper order is to govern the acceptance of delivery (whether on purchase, toll agreement or otherwise) of specified types of copper and copper alloy materials (other than controlled materials) and copper-clad and copper-base alloy-clad steel scrap.

More Educational Films Available

The Bureau of Mines of the Department of Interior recently announced the availability of five new films which depict some of the manufacturing processes used in the fabrication of aluminum and aluminum alloys. These are known as (1) "General Sheet Metal Practices," (2) "Blanking and Piercing," (3) "Tube and Shape Bending," (4) "Drawing Stretching, and Stamping," and "Spinning." Two other new 16-millimeter sound films which have been made available to *Metal Finishing* readers for showing to employees and branch meetings of the AES are known as "First Steps in First Aid," and "Help Wanted." The Bureau's film library has about 9,000 reels of sound and silent films. Some of these films show production methods, processing techniques, and industrial utilization of such metals as aluminum, copper, lead, nickel, and steel. The loan of these films is free, except for the cost of transportation. Application for films should be made to the Graphic-Services Section, Bureau of Mines Experiment Station, 4800 Forbes Street, Pittsburgh 13, Pennsylvania.

Financing Small Business Speeded Up

The Smaller War Plants Corporation announced on February 1, 1944, that its new policy increases the amount that banks are permitted to carry under a deferred participation from $100,000 to $250,000 where the bank takes a direct participation in the loan of 10 per cent or more. Interest up to 6 per cent per annum is allowed on that part of the loan which the bank carries at its own risk; and on the balance, which is carried under a deferred participation, interest of 4 per cent per annum is charged and the bank pays to SWPC a graduated fee of from one-half of one per cent to 1 per cent per annum, depending on the percentage of the bank's participation. "This new policy," Chairman Maury Maverick said, "will enable the small businessman to obtain financing more quickly and make possible his continued dealing with the local bank." All firms engaged in the production of war materials or essential civilian items who require financing can obtain details of this new procedure at the nearest SWPC field office.

Galvanized Ware Committee Meets

Members of the Galvanized Ware Manufacturers Industry Advisory Committee of the War Production Board were told by the Board on February 8, 1944, that "no large scale relaxation of the controls over production of civilian goods in general can be considered until the outcome of impending military operations is known." The committee members were also told that all those who experience difficulty in placing orders for galvanized sheets should inform the Consumers Durable Goods Division of the WPB of their needs so that all possible assistance may be given to them. Possible changes in Limitation Order L-30-a were also discussed at the meeting.

Material Substitution List Revised

The War Production Board's Conservation Division, on January 31, 1944, issued its 11th edition of "Material Substitution and Supply List." This list, which covers about 450 materials needed for war uses, shows an easing of copper and steel. Tin continues to be short in supply. It recommends that tin be used as little as possible in bronzes and plating.

Dictionary of Metal Finishing Chemicals

Silver Cyanide: AgCN. Mol. wt. 133.898. Sp. gr. 3.95. Hexagonal white crystals or white powder. Darkens on exposure to light. Decomposes at 320°C. Insoluble in water. Soluble in hot nitric acid, in hot sulfuric acid, in ammonium hydroxide, in cyanide solutions, in thiosulfate solutions. Grades: Technical. Containers: Bottles (1, 16, 50, 80, 100, 160 oz.); Tins (16, 80, 100, 500 oz.).

Silver Iodide: AgI. Mol. wt. 234.80. Sp. gr. 5.67. Hexagonal pale yellow crystals or powder. Darkens on exposure to light. Decomposes when heated to 552°C. Insoluble in water. Slightly soluble in ammonium hydroxide. Soluble in cyanide solutions and in thiosulfate solutions. Soluble in hydriodic acid. Soluble in solutions of potassium iodide and of sodium chloride. Grades: Technical, C. P. Containers: Glass Bottles (1, 4, 16 oz.).

Silver Nitrate: $AgNO_3$. Mol. wt. 169.888. Sp. gr. 4.352. M. P. 212°C. Rhombic colorless crystals or white powder. Darkens on exposure to light. Decomposes at 444°C. Solubility, 122 at 0°C. and 952 at 100°C. Soluble in ether and in glycerine. Very slightly soluble in alcohol. Grades: Technical, U. S. P., C. P. Containers: Bottles (1, 4, 16, 50, 80, 100, 200, 250 oz.).

Silver Nitrate, Fused: White hard pencils of silver nitrate, q.v. darkening on exposure to light. Also known as Lunar Caustic.

Silver Oxide: Ag_2O. Mol. wt. 231.760. Sp. gr. 7.14. Cubic brownish black crystals or powder. Decomposes at 300°C. Insoluble in water. Soluble in nitric acid, in sulfuric acid, in cyanide solutions and in ammonium hydroxide. Grades: Technical, U. S. P., C. P. Containers: Bottles (1, 4, 16, 100 oz.).

Silver Sulfate: Ag_2SO_4. Mol. wt. 311.82. Sp. gr. 5.45. M. P. 652°C. Rhombic white crystals or powder. Very slightly soluble in water. Soluble in sulfuric and in nitric acids. Soluble in ammonium hydroxide. Grades: Technical, C. P. Containers: Bottles (1, 4, 16, 50, 80, 100 oz.).

Silver Sulfide: Ag_2S. Mol. wt. 247.82. Sp. gr. 7.3. M. P. 825°C. Also known as Silver Sulfuret. Rhombic or cubic gray black crystals or black powder. Insoluble in water. Soluble in sulfuric acid, nitric acid and cyanides. Grades: Technical, C. P. Containers: Bottles (1, 4, 16 oz.).

Silver Sulfuret: See Silver Sulfide.

Silver Thiocyanate: AgCNS. Mol. wt. 165.96. Colorless crystals or white curdy solid. Decomposes when heated. Insoluble in water. Insoluble in acids. Soluble in ammonium hydroxide. Grades: Technical, C. P. Containers: Bottles (1, 4, 16, 100 oz.).

Silver Thiosulfate: $Ag_2S_2O_3$. Mol. wt. 327.88. White solid. Decomposes when heated. Slightly soluble in water. Soluble in ammonium hydroxide and in thiosulfate solutions.

Single Nickel Salt: See Nickel Sulfate.

Slaked Lime: See Calcium Hydroxide.

Soap: Usually the sodium salt of a fatty acid but may be any salt of a fatty acid such as a lime soap or lead soap. The usual fatty acids are oleic, stearic, palmitic, contained in fats and oils. See below.

Soap Bark: Bark of the South American Quillaya tree used as a lubricant in scratch brushing. Grades: Technical, N. F.-powder chips. Containers: Cartons, Cans (1, 10, 25 lb.); Kegs (100, 125 lb.); Barrels (150, 160, 250 lb.).

Soap, Fig: A soft soap made of low titer vegetable oils, usually linseed, or red oil. Has crystalline areas or spots throughout due to the crystallization of the high titer components of the oil apparently.

Soap, Green: See Soap, Soft.

Soap, Lime: Calcium salt of fatty acid. Insoluble in water and usually due to reaction between the sodium soaps and the calcium content of the water.

Soap, Rosin: A soap made with rosin or colophony, q.v. Also known as Sodium Resinate. Odorless yellowish powder or sticky paste with disagreeable odor. Grades: Technical. Containers: Bottles (1, 5, 10, 25 lb.); Cans; Barrels.

Soap, Soft: Also known as Green Soap. Yellowish green paste made from linseed oil and potassium hydroxide. Very soluble. Grades: Technical, U. S. P. Containers: Tins (1, 5, 10, 25 lb.); Kegs (125 lb.); Barrels (450 lb.).

Soap, Whale Oil: Paste with strong odor. Made from whale oil. Sold with and without ammonia. Grades: Technical. Containers: Tins (1, 5, 10, 25, 50 lb.); Tubs (100 lb.); Drums (175 lb.); Barrels (400 lb.).

Soapstone: See Talc.

Soda: Old term for Sodium Carbonate, q.v.

Soda Alum: See Aluminum Sodium Sulfate.

Soda Ash: See Sodium Carbonate, Anhydrous.

Soda, Baking: See Sodium Bicarbonate or Potassium Bicarbonate.

Soda, Caustic: See Sodium Hydroxide.

Soda, Lye: See Sodium Hydroxide.

Soda, Washing: See Sodium Carbonate, Decahydrate.

Soda, Modified: Mixtures of soda ash and sodium bicarbonate having an alkalinity between the two. White crystalline powders with good detergent properties. Grades: Technical. Containers: Barrels.

Sodium: Na. At. wt. 22.997. Sp. gr. 0.971. M. P. 97.5°C. Cubic, silvery metal lumps. Oxidizes rapidly in air. Decomposes water, liberating hydrogen. Decomposes in alcohol. Insoluble in benzene and in ether. Grades: Technical, C. P. Containers: Bottles (1, 4, 16 oz., 5 lb.); Tins (1, 5 lb.); Drums (280 lb.).

Sodium Acetate: $NaC_2H_3O_2{\cdot}3H_2O$. Mol. wt. 136.089. Sp. gr. 1.45. M. P. 58°C. Monoclinic, colorless, efflorescent crystals. Also fused crystals, flakes and granules. Soluble in water. Slightly soluble in alcohol. Grades: Technical, U. S. P., C. P., granular, crystals and fused crystals. Containers: Bottles, Cans (1, 5 lb.); Boxes (25 lb.); Kegs (25, 100, 125 lb.); Drums (275 lb.); Barrels (300, 325, 350, 375, 400, 450 lb.).

Sodium Acetate Anhydrous: $NaC_2H_3O_2$. Mol. wt. 82.041. Sp. gr. 1.53. M. P. 324°C. White powder. Solubility, 119 at 0°C. and 170 at 100°C. Slightly soluble in alcohol. Grades: Technical, Pure, C. P. Containers: Bottles (1, 5 lb.).

Sodium Acid Carbonate: See Sodium Bicarbonate.

Sodium Acid Chromate: See Sodium Dichromate.

Sodium Acid Fluoride: See Sodium Bifluoride.

Sodium Acid Oxalate: See Sodium Binoxalate.

Abbreviations: Mol. wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than Technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary.

Sodium Acid Phosphate: See Sodium Phosphate-Mono.

Sodium Acid Phosphate-Di: See Sodium Phosphate-Di.

Sodium Acid Sulfate: See Sodium Bisulfate.

Sodium Acid Sulfite: See Sodium Bisulfite.

Sodium Aluminate: $NaAlO_2$. Mol. wt. 81.97. M. P. 1650°C. Amorphous white powder. Soluble in cold water. Very soluble in hot water. Insoluble in alcohol. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Boxes (5, 25 lb.); Kegs (100 lb.); Bags (160 lb.).

Sodium Aluminum Sulfate: See Aluminum Sodium Sulfate.

Sodium Ammonium Phosphate: $NaNH_4HPO_4 \cdot 4H_2O$. Mol. wt. 209.09. Sp. gr. 1.57. Also known as Microcosmic Salt. Monoclinic colorless efflorescent crystals. Decomposes at 79°C. Solubility, 16.7 at 0°C. and 100 at 100°C. Insoluble in alcohol. Grades: Technical, Purified, C. P. Containers: Bottles, Cans (1, 5 lb.); Kegs (25, 50, 100 lb.); Barrels (250 lb.).

Sodium Aurocyanide: See Sodium Gold Cyanide.

Sodium Bicarbonate: $NaHCO_3$. Mol. wt. 84.015. Sp. gr. 2.20. Monoclinic white crystals or powder. Also known as Baking Soda, Bicarbonate of Soda, Sodium Acid Carbonate. Loses carbon dioxide gas when heated to 270°C. Solubility, 6.9 at 0°C. and 16.5 at 60°C. Insoluble in alcohol. Grades: Technical, Pure, U. S. P., C. P. Containers: Bottles, Cartons (1, 5 lb.); Boxes (5 lb.); Kegs (25, 50, 100, 112 lb.); Bags (300 lb.); Barrels (300, 400 lb.).

Sodium Bichromate: See Sodium Dichromate.

Sodium Bifluoride: $NaHF_2$. Mol. wt. 62.01. Also known as Sodium Acid Fluoride. Rhombohedral colorless crystals or white crystalline powder. Soluble in water. Grades: Technical. Containers: Bottles (1 lb.); Cans (5, 25 lb.); Kegs (100 lb.); Barrels.

Sodium Binoxalate: $NaHC_2O_4 \cdot H_2O$. Mol. wt. 130.041. Also known as Sodium Acid Oxalate. Monoclinic white crystals. Slightly soluble in water. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.).

Sodium Biphosphate: See Sodium Phosphate-Mono.

Sodium Bisulfate: $NaHSO_4 \cdot H_2O$. Mol. wt. 138.08. M. P. 300°C. Also known as Sodium Acid Sulfate. Monoclinic colorless crystals and granules. Very soluble in water. Insoluble in alcohol. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Cartons (5, 25 lb.); Kegs (100 lb.); Barrels (375, 700 lb.); Drums (100 lb.).

Sodium Bisulfate, Anhydrous: $NaHSO_4$. Mol. wt. 120.07. Sp. gr. 2.742. Melts at varying temperatures above 315° C. Also known as Niter Cake, Nitre Cake, Sodium Acid Sulfate, Fused Sodium Bisulfate. Triclinic colorless crystals, fused lumps or granules. Solubility, 50 at 0°C. and 100 at 100°C. Decomposes in alcohol. Grades: Technical, Pure, C. P. Containers: Bottles (1, 5 lb.); Cartons (5, 25 lb.); Kegs, Drums (100 lb.); Barrels (250, 375, 500 lb).; Bulk.

Sodium Bisulfate, Fused: See Sodium Bisulfate, Anhydrous.

Sodium Bisulfite: $NaHSO_3$. Mol. wt. 104.07. Sp. gr. 1.48. Also known as Sodium Acid Sulfite. Monoclinic white crystals, granules or powder. Decomposes when heated. Slightly soluble in cold water. Soluble in hot water. Insoluble in alcohol. Grades: Technical, C. P., 32°-44° Be solution. Containers: Bottles, Cans (1, 5 lb.); Boxes (10, 25, 50 lb.); Kegs (100, 125 lb.); Barrels (400, 413, 425, 430, 450, 500 lb.); Drums (100, 500, 600 lb.). Solution, 32° Bé—Carboys (125, 140 lb.); Tank trucks (14,000 lb.).

Sodium Bitartrate: $NaHC_4H_4O_6 \cdot H_2O$. Mol. wt. 190.093. Also known as Sodium Acid Tartrate. White crystalline powder. Soluble in cold water. Very soluble in hot water. Very slightly soluble in alcohol. Grades: Technical, C. P., Purified. Containers: Bottles, Cartons (1, 5 lb.); Kegs (100 lb.).

Sodium Borate: $Na_2B_4O_7 \cdot 10H_2O$. Mol. wt. 381.43. Sp. gr. 1.73. M. P. 75°C. Also known as Sodium Biborate, Sodium Tetraborate, Borax. Monoclinic colorless crystals or white powder or granules. Solubility 1.3 at 0°C. and 201 at 100°C. Very slightly soluble in alcohol. Soluble in glycerine. Grades: Technical, U. S. P., C. P. Containers: Bottles, Cartons, Boxes (1. 5 lb.); Cartons (1, 5, 25, 50 lb.); Kegs, Drums and Bags (100 lb.); Bags (125 lb.); Barrels (300, 340, 390 lb.); Bulk.

Sodium Borate, Anhydrous: $Na_2B_4O_7$. Mol. wt. 201.27. Sp. gr. 2.37. M. P. 741°C. Also known as Borax Glass, Fused Borax White lumps, granules or powder. Solubility, 1.5 at 0°C. and 8.8 at 40°C. Grades: Technical. Containers: Bottles (1, 5 lb.); Tins (1, 10, 50 lb.); Cases (100 lb.).

Sodium Borate-Per: $NaBO_3 \cdot 4H_2O$. Mol. wt. 153.88. Monoclinic colorless crystals or white powder. Slightly soluble in cold water. Decomposes in hot water. Decomposes when heated to about 40°C. Grades: Technical, U. S. P., N. F., C. P. Containers: Bottles, Cartons (1, 5 lb.); Boxes (25, 50 lb.); Kegs (100, 125 lb.); Barrels (225, 250, 275 lb.).

Sodium Borate-Tetra: See Sodium Borate.

Sodium Bromide: NaBr. Mol. wt. 102.913. Sp. gr. 3.21. M. P. 755°C. Colorless, cubic or white crystals, granules or powder. Solubility, 116 at 52°C. and 121 at 100°C. Slightly soluble in alcohol. Grades: Technical, U. S. P., C. P. Containers: Bottles, Cans (1, 5 lb.); Boxes, Drums (25, 50, 100 lb.); Kegs (100 lb.); Barrels (500 lb.).

Sodium Carbonate: See various kinds below.

Sodium Carbonate, Anhydrous: $NaCO_3$. Mol. wt. 106.004. Sp. gr. 2.533. M. P. 851°C. Also known as Soda Ash. Hygroscopic white powder, granules or lumps. Solubility, 7.1 at 0°C. and 45.5 at 100°C. Insoluble in alcohol. Grades: Technical (48% and 58%, Sod. oxide), Purified, C. P. Containers: Bottles, Cartons, Cans (1, 5 lb.); Cans, Kegs (25 lb.); Bags (100 lb.); Kegs (125 lb.); Barrels (200, 300 lb.).

Sodium Carbonate, Monohydrate: $Na_2CO_3 \cdot H_2O$. Mol. wt. 124.044. Sp. gr. 1.55. Also known as Crystal Carbonate. Rhombic colorless crystals. Loses molecule of water at 100°C. Solubility, 33 at 20°C. and 56 at 100°C. Insoluble in alcohol. Soluble in glycerine. Grades: Technical, U. S. P., C. P. Containers: Bottles, Cans (1, 5 lb.); Kegs (25, 100 lb.); Barrels (400 lb.).

Sodium Carbonate, Decahydrate: $Na_2CO_3 \cdot 10H_2O$. Mol. wt. 286.164. Sp. gr. 1.46; Also known as Sal Soda, Washing Soda. White monoclinic crystals. Loses 5 molecules of water when heated to 34°C. Solubility, 21.5 at 0°C. and 421 at 104°C. Insoluble in alcohol. Grades: Technical, C. P. Containers: Bottles, Cartons (1, 5 lb.); Tins (5, 25 lb.); Drums (100, 250 lb.); Kegs (120, 125 lb.); Barrels (350 lb.).

Sodium Chlorate: $NaClO_3$. Mol. wt. 106.454. Sp. gr. 2.490. M. P. 248°C. Colorless trigonal or cubic crystals. Decomposes when heated to high temperatures. Solubility, 79 at 0°C. and 230 at 100°C. Soluble in alcohol and glycerine. Grades: Technical, U. S. P., C. P. Containers: Bottles, Cartons (1, 5 lb.); Boxes, (25 lb.); Kegs (100, 112 lb.); Drums (112 lb.).

Abbreviations: Mol. Wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than Technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary.

SHOP PROBLEMS

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Ferroxyl Test Reagent

Question: We are interested in making a reagent for a porosity test called the Ferroxyl test, containing sodium chloride, potassium ferricyanide and agar-agar.

However the agar-agar has been off the market for some time, and we are unable to purchase same. Please advise us if there is a substitute that we can use.

Also advise us the number of pores per square inch that would be acceptable as a good plate in chrome, nickel, and copper deposits. That is the individual plates, and also when the three are combined. Please advise the number of pores permissible in a chrome plate direct on steel .002" to .003" thick. Would appreciate any data you may have on hand, for chromating and anodizing and what we should look for in purchasing a generator for anodizing 40 volts 1 to 5 amperes per square foot.

R. P., Ltd.

Answer: It is not necessary to use agar-agar in the ferroxyl test reagent. This solution can be made up with only sodium chloride and potassium ferricyanide. The National Bureau of Standards has found that 60 g./L. and 0.5 g./L. respectively give the most consistent results with blue spots appearing at the pores in from 10-20 minutes. If a gel is preferred to a solution in order to prevent the blue spots from spreading, 20 g./L. of gelatin may be added.

There are no standard figures on the number of pores allowable for any particular deposit. Since there is some attack upon the deposit, however, the ferroxyl test will not only indicate the pores but will also show any very thin spots in the deposit. The attack will naturally vary with the time and temperature and reproducible results will be obtained only if these conditions are not varied.

Data on chromic acid anodizing will be found in the 1943 edition of the *Plating and Finishing Guidebook,* pages 55-7.

Chromatizing is a process involving immersion for five minutes in a 5% chromic acid solution with the temperature maintained at 140°F. This process is used to provide a corrosion resistant film on aluminum assemblies having inserts which would require stopping off if anodized. The coating, however, is not as good as the anodized coating.

It is suggested that a capacity of 10 amp./sq. ft. be allowed when calculating the size of the electrical equipment and a current source which can be controlled down to five volts should be specified in order that the initial high current surge may be kept within the limits of the machine rating.

Phosphoric Acid Inhibitors

Question: I have read with great interest your article by Mears and Eldredge on "The Use of Inhibitors for Aluminum Chemical Equipment" in the August 13, 1943, issue of the *Metal Industry.*

You make the statement in the paragraphs under "Acid Solutions" that, "It was found that both anionic and cationic types of wetting agents were effective inhibitors in Phosphoric Acid." It seems to me that an anionic emulsifier by the very definition of the term would not be stable in an acid solution. Would you kindly explain this point more fully?

May I be favored with the names of the emulsifying agents (cationic and anionic) which you have found to be useful as inhibitors in phosphoric acid solutions.

A. C. P.

Answer: This is to acknowledge receipt of your inquiry of November 15th and to advise that you probably have us confused with "Metal Industry" which is published in London.

In any case, the article to which you refer was originally presented before The Electrochemical Society and will be found in its complete form in the Transactions, Electrochemical Society, Volume 83, Preprint 16, (1943). The statement mentioned in your letter appears on page 204.

It is suggested that you communicate with R. B. Mears at the Aluminum Research Laboratories, New Kensington, Pa., who will be able to furnish you with the names of phosphoric acid inhibitors.

Silver Plating

Question: We are sending you a sample of our silver plating solution. Would like to know if you can give us any information as to what is wrong with it, and if anything can be done to make it work again.

It had been working very satisfactory, this is about a 40 gal. solution, and shortly after we added 25 ounces of silver, it would not plate at all. Please advise.

F. A. K.

Answer: We have analyzed the sample of your silver solution and report as follows:

Metallic silver	4.72 tr. oz./gal.
Free cyanide	4.00 av. oz./gal.

This solution has sufficient metal and cyanide although you may get somewhat better operation by increasing the free cyanide content to five ounces by the addition of one ounce per gallon of sodium cyanide.

From the analysis, the solution should operate satisfactorily unless some contaminating material is present which would cut the cathode efficiency down to zero.

If the solution does not give any appreciable amount of gassing at the cathode, we would suggest that you check all the connections in order to determine whether current is flowing through the work and the solution.

Maintaining Silver Plating Solution

Question: Will you be kind enough to give us some further information on the problem we submitted to you about a month ago—silver plating on stainless steel?

We made up a solution as you directed and were getting fine results. Now, however, we find that the nickel anodes (which we use for regular plating) get covered with a black substance as do the item that we strike in the solution and the solution itself.

Is there anything we have to do from time to time to keep the solution in as good a working state as it was when we made it up? Also, what is the quickest and surest way of distinguishing plain from stainless steel?

—S. P. Co.

Answer: We believe that the acidity of your solution has been neutralized by constant operation, which is to be expected in view of the fact that the anode efficiency is 100% while the cathode efficiency is very low. The result is that much more nickel dissolves into the solution from the anodes than is plated and thus the acid content of the solution drops.

We suggest that you analyze your solution for acidity and make the required addition of hydrochloric acid. If such analysis is not convenient, we advise that you add one pint per gallon of hydrochloric acid to it.

The quickest way to tell whether a sample is plain or stainless steel is to place a drop of a solution containing 1 oz./gal. copper sulfate crystals and ½ oz./gal sulfuric acid on it. A bright copper coating will be formed on plain steel surfaces but no reaction will be noted on stainless steel.

Patents

Corrosion Prevention Iron and Steel

U. S. Pat. 2,333,206. C. K. Sloan, assignor to E. I. duPont de Nemours & Co., Nov. 2, 1943. The process for the protection from atmospheric corrosion of metallic surfaces susceptible to said corrosion which comprises applying to said surfaces a film of an acyclic aliphatic monoamine having an aliphatic group of a chain length of at least 8 carbon atoms, so as to provide a layer of amines having a thickness within the range corresponding to a spread of 10,000 sq. ft. to 80,000 sq. ft./lb. of amines.

The process in accordance with claim 1 characterized in that the metallic surface is a ferrous metal surface that has been oxidized, which oxidized ferrous metal surface has been pretreated with an acid reagent selected from the group consisting of phosphoric, chromic, molybdic and oxalic acids and their acid salts prior to the applying of the amine.

Example:

9, 10-Octadecenylamine	[illegible] parts
Toluol	[illegible] "

Electrolytic Polishing

U. S. Pat. 2,334,698. C. L. Faust, assignor to Battelle Memorial Institute, Nov. 23, 1943. A new article of manufacture having a stainless steel surface, said surface being anodically polished to remove metal therefrom and render said surface free from mechanical strain and from amorphous layers and showing substantially no crystalline structure microscopically.

The method of imparting a lustrous surface to stainless steel, which comprises making such steel and anode in an aqueous acid electrolyte consisting initially of about eleven per cent water by weight, sulfuric acid, and phosphoric acid, each of said acids being present in substantial effective amounts, and passing an electric current therethrough of sufficient density and for a sufficient period of time to obtain such lustrous surface.

Examples:

1.	Sulfuric acid	15 parts by wt.
	Phosphoric acid	63 " " "
	Water	22 " " "
2.	Sulfuric acid	50 " " "
	Glycerol	40 " " "
	Water	10 " " "
3.	Sulfuric acid	60 " " "
	Phosphoric acid	30 " " "
	Water	10 " " "

Electrolytic Polishing

U. S. Pat. 2,334,699. C. L. Faust, assignor to Battelle Memorial Institute, Nov. 23, 1943. An electrolytic solution for use in the anodic polishing of metals selected from the group consisting of iron and its alloys, nickel and its alloys and German silver, consisting essentially of from 5 to 85% of sulfuric acid and from 5 to 85% of ortho phosphoric acid, the combined acid content being at least 50% but not over 90% by weight of said solution and the balance being mainly water.

Examples:

1.	Sulfuric acid	15 parts by wt.
	Phosphoric acid	63 " " "
	Water	22 " " "
	Temp.: 40-50° C.	
	Time: 4-20 mins.	
	C.D.: 100-250 amp./sq. ft.	
2.	Sulfuric acid	15 parts by wt.
	Phosphoric acid	63 " " "
	Water	12 " " "
	Chromic acid	10 " " "
	Temp.: 50° C.	
	C.D.: 250 amp./sq. ft.	

Electrolytic Polishing

U. S. Pat. 2,335,354. J. N. Ostrofsky, assignor to Rustless Iron and Steel Corp., Nov. 30, 1943. The method of polishing stainless iron and stainless steel by anodic treatment comprising immersing the metal to be polished in an aqueous bath consisting principally of an aliphatic-carboxylic acid, a soluble compound having a sulphate radical yielding a sulphate ion in the bath, and water in an amount less than approximately 50% by weight of the bath, and passing direct current through the bath using the metal as the anode, the current being of sufficient density to offset the gray etching action of the bath on the metal and to impart a polish thereto.

Examples:

1.	Sulfuric acid	2–60%
	Citric acid	10–80%
	Water	20–40%
	Temp.: 100° C.	
	Time: 1 minute (for 18/8).	
	C.D.: 2.5 amp./sq. in.	
2.	Acetic acid	55%
	Sulfuric acid	15%
	Water	30%
	Temp.: 60° C.	
	Time: 1 minute.	
	C.D.: 10 amp./sq. in.	
3.	Tartaric acid	60%
	Sulfuric acid	8%
	Water	32%
	Temp.: 100° C.	
	Time: 30 seconds.	
	C.D.: 10 amp./sq. in.	

Palladium Bath

U. S. Pat. 2,335,821. E. M. Wise and R. F. Vines, assignors to International Nickel Co., Inc., Nov. 30, 1943. A process for electrodepositing ductile thick coatings of palladium which comprises electrolyzing an aqueous bath having a palladium-ion content greater than 10^{-8} and consisting of about 25 to about 50 grams of palladium per liter as the chloride, about 50 cc. to 700 cc. of concentrated hydrochloric acid per liter, and about 2.5 to about 50 grams of ammonium chloride per liter at a temperature of about 20° C. to about 90° C. whereby thick ductile electrodeposits of palladium are obtained.

Example:

Palladium (as chloride)	50 g./L.
Ammonium chloride	20–50 "
pH (Glass electrode)	0–0.5 "

Temp.: 50° C.
C.D.: 10 amp./sq. ft.
Anodes: Palladium (preferably melted under oxidizing conditions).
Agitation: Desirable.

Buffers such as oxalic, phosphoric, acetic, boric, citric, trichloracetic and monochloracetic acids may be used. Cathode and anode efficiencies are approximately 100%. The palladium may be dissolved either with a porous pot or in aqua regia and boiled to remove excess acid.

Corrosion Prevention of Iron and Steel

U. S. Pat. 2,335,868. H. J. Lodeesen, assignor to Parker Rust Proof Co., Dec. 7, 1943. The method of coating ferrous metal surfaces which comprises applying to the surface a solution of a coating phosphate which is non-oxidizable by permanganate, said solution containing permanganate, the MnO_4 in the solution being from .0005% to .005%, and maintaining the pH of the solution above equilibrium.

Example:

Zinc (as zinc dihydrogen phosphate)	0.2–0.3%
Permanganate ion	0.0005–0.005%
pH	0.12–0.38 units above equilibrium

For replenishing, the following solution is used:

Zinc dihydrogen phosphate 6.7–7 lbs
Zinc: Permanganate ratio 3.5:1–7:1 by wt.

Corrosion Prevention

U. S. Pat. 2,336,071. W. J. Clifford and H. H. Adams (England), assignors to Parker Rust Proof Co., Dec. 7, 1943. A composition comprising an acid phosphate coating solution containing an organic compound which contains the nitroso group, said compound being dissolved in the solution in an amount that accelerates the coating action of the solution.

Examples:

Nitroso-N-methylurethane	0.2 %
p-Nitroso-dimethylaniline	0.04%
p-Nitrosophenol	0.4 %

Corrosion Prevention

U. S. Pat. 2,336,072. W. J. Clifford and H. H. Adams (England), assignors to Parker Rust Proof Co., Dec. 7, 1943. A composition comprising an acid phosphate coating solution containing as accelerator an organic compound which contains the trichloromethyl group, said compound being dissolved in the solution in an amount which accelerates the coating action of the solution.

Examples:

Chloral	0.2 %
Trichloracetic acid	0.05%

Inhibiting Spots on Tinned Copper

U. S. Pat. 2,336,615. H. C. Jennison and J. C. Bradley, assignors to The American Brass Co., Dec. 14, 1943. A method of inhibiting formation of black spots on tinned copper which consists in electrodepositing on the tinned surface an amount of at least one of the metals of the group consisting of nickel, cobalt and iron sufficient to inhibit black spot formation, and with the resultant coating essentially tin and of at least about 90 per cent of this metal.

Inhibiting Spots on Tinned Copper

U. S. Pat. 2,336,616. H. C. Jennison and J. C. Bradley, assignors to The American Brass Co., Dec. 14, 1943. A method of inhibiting formation of black spots on tinned copper by contact with liquids, food and beverage products which consists in electrodepositing on the copper a coating of tin and at least one of the metals in the group consisting of manganese and chromium in amount sufficient to inhibit black spot formation and with the resultant coating essentially tin and of at least about 90 per cent of this metal.

Abrasive Blasting Machine

U. S. Pat. 2,338,591. W. J. Learmonth, assignor to The Studebaker Corp., Jan. 4, 1944. The combination of a housing, means for discharging shot in said housing, an endless wheeled conveyor for conducting objects to be shot blasted through said housing, a track upon which the wheels of said conveyor are adapted to travel having a slot therein adjacent the discharge end of said housing, and means for directing an air stream through said slot inwardly of said housing.

Vitreous Enamel

U. S. Pat. 2,339,260. L. J. Frost and C. H. Commons, Jr., assignors to The Titanium Alloy Mfg. Co., Jan. 18, 1944. The process of producing an enamel frit which comprises adding to the glass forming materials of the raw batch zirconium silicate and aluminum phosphate in such proportions that the mixture contains from 7 to 15 per cent zirconium silicate and from 0.25 to 4 per cent aluminum phosphate.

Polonium Plating

U. S. Pat. 2,339,545. J. H. Dillon, assignor to The Firestone Tire and Rubber Co., Jan. 18, 1944. The method of removing surface lead oxide from polonium-plated metal which comprises treating the plated metal with approximately 37 per cent aqueous nitric acid.

Polishing Machine

U. S. Pat. 2,340,130. G. L. Leithiser, assignor to General Electric Co., Jan. 25, 1944. Wire polishing apparatus comprising an elastic polishing member having an aperture therein for receiving the wire, the perimeter of the aperture thereof being substantially equal to the required perimeter of the finished wire, and adjustable pressure means acting on the outer perimeterical surface of said member for forcing it to assume the general shape of the cross-section of said wire, and means for rotating said member around the wire.

Insoluble Anode

U. S. Pat. 2,340,400. C. L. Mantell, assignor to Electro Manganese Corp., Feb. 1, 1944. An anode for manganese electrowinning having the following composition:

Cobalt	0.02 to 0.04
Tin	20 to 25
Antimony	4 to 6
Balance	Principally lead

pH Meter

U. S. Pat. 2,340,641. A. E. Cameron, assignor to B. D. Eisendrath Tanning Co., Feb. 1, 1944. In a hydrogen ion meter, in combination, an electrode system, a thermionic tube having its grid connected to said electrode system, potentiometer means for applying a voltage in bucking relation to the voltage produced by said electrode system, a potentiometer means in bucking relation to first said potentiometer means, an electric meter adapted to be connected to the plate circuit of said tube, and means for connecting said meter to first said potentiometer means.

pH Electrode Assembly

U. S. Pat. 2,340,642. A. E. Cameron, assignor to B. D. Eisendrath Tanning Co., Feb. 1, 1944. In an electrode assembly, a reference half-cell comprising a tube, an electrolyte therein, said tube having an orifice in a side thereof and a circumambient rubber band resiliently engaging said tube, overlying said orifice and substantially preventing diffusion between said orifice and the edges of said band.

Corrosion and Its Prevention in the Plating Room

(*Concluded from page* 138)

Nearly all plating rooms have a number of insulated busbars and occasionally cable to conduct D.C. current to the plating tanks. This is normally made of copper or aluminum. In times when these materials are scarce, such as at present, silver sometimes is substituted, since it is not a critical metal and its electrical resistance is extremely low. Copper has a fair resistance to alkalis and most acids except nitric. Aluminum is resistant to some acids but is attacked by alkalis. Silver is not readily attacked by either since it oxidizes quickly in room air, forming a self-protecting coating.

In any event, these cables or busbars should be amply protected by paint or other means. Acid resisting paint is, of course, the best and should be applied thoroughly and strictly according to the recommendations of the manufacturer. If cable is used it can be protected by loom and the ends sealed with asphalt. The loom in turn can be painted if desired, but this is not absolutely necessary. It is well to use a light color in painting cables or bus so as to show up any signs of corrosion readily.

Racks and other miscellaneous plating room accessories last several times as long if adequately protected. There are many good preparations on the market in which these articles can be dipped and which form a rubber-like protecting coat over the vulnerable parts. Sections which are used to conduct current can be cleaned off readily by removing part of the skin-like coating. These coatings are reasonable in price and can be purchased in drums, sufficiently large to dip a good sized rack. As the material wears off, it can be renewed periodically. Hooks, tank stoppers, tank bars not used for conducting current, large mesh dipping baskets and miscellaneous tools are some of the other articles for which this material is useful.

The exhaust ductwork in plating rooms is ordinarily constructed of heavy sheet metal which is given several coats of asphalt paint on the inside and either asphalt or some form of acid resisting paint on the outside. If properly maintained this will last for several years but the metal work near the tanks must be constantly maintained and kept well coated with paint. A better and more permanent material to use is the "Chemstone" or "Transite" board manufactured by Johns Manville. Transite is resistant to most acids and alkalis and does not require painting, thus lowering the maintenance coast. It can be fabricated in any shape required. Chemstone is even better as an acid and alkali resistor but is about 20% more expensive than Transite. These materials (in 1/4" thickness) are about the same weight per sq. foot, as 16 gauge sheet metal and their erected cost often compares favorably with a sheet metal installation. The material is composed of cement and asbestos with the addition of various other inert materials to make the product extra resistant.

Plating and cleaning tanks should, of course, be amply protected from the solutions they contain. Generally speaking, the trend today is away from wooden tanks and toward steel with inner linings, the protective substance depending on what solution the tank contains. A complete discussion on tanks and their design is planned for a later article.

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Plastic Coated Material Used for All Purpose Aprons

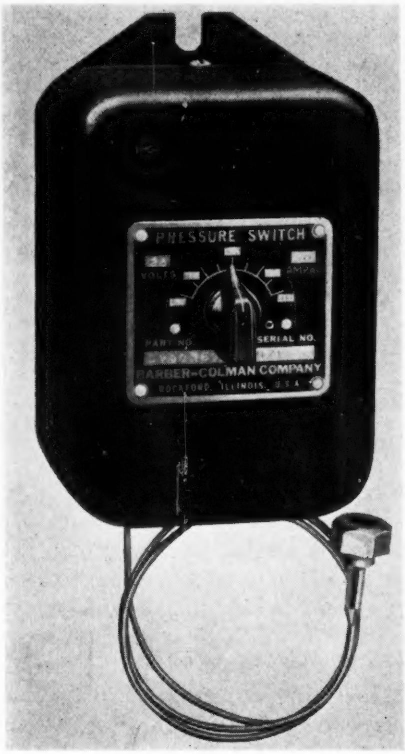
With rubber aprons a thing of the past, many industrial shops are turning to a new plastic apron (black) which resists oils, acids and other damaging agents. The plastic is moulded clear through a heavy diagonally woven Jean Cloth which results in a durable, flexible material permitting maximum working ease.

The manufacturer states he can fill orders immediately. Aprons are made in the following sizes: 27 x 36", 30 x 36", 36 x 40" and 36 x 44". For further information write The Farnham Manufacturing Co., Dept. MF, 201 N. Wells St., Chicago 6, Ill.

Professional Directory

Micro Pressure Switch

Manufactured by Barber-Colman Co., Dept. MF, Rockford, Ill, for proportioning control of motor-operated valves, power units, program switches, etc., for the regulation of steam, air and gas pressures. Some of the many applications are control of steam



boilers, automatically fired by proportioning type oil burners, gas burners, and stokers, suction pressure of multiple Freon compressors and regulation of head pressures in liquid level control.

A single-pole double-throw 3-wire instrument with positioning solenoid. Pressure sensitive bellows mechanism, mounted on a bakelite sub-base and enclosed in a metal case for surface mounting. Built-in condenser protects contacts. Convenient external adjustment, but setting may be locked in place by means of internal locking screws.

Simple 4-wire—single-pole double-throw for 3-wire operating circuit plus additional wire for positioning solenoid. Micro pressure switch is a unit of the Barber-Colman Micro system of control in which no potential sensitive relays or relay detectors are required.

Industrial Gloves

Two styles of industrial gloves made from synthetic rubber are now being manufactured by The B. F. Goodrich Company, Dept. MF, Akron, Ohio. They can be sold to anyone who can qualify under Rubber Order R-1.

One of the gloves is a lightweight type of .15 inch gauge, 10½ inch length. Sizes, in halves, range from 7 to 11, inclusive. The second glove is of .30 inch gauge, 14 inches in length, in sizes 10, 10½ and 11. The heavier glove is available only in the straight-finger style. It is hoped that manufacture of the curved-finger type will be possible in the near future.

Sizes and gauges of the two types were carefully worked out to meet the greatest average demand, the company's announcement says. It also declares that the synthetic rubber gloves are equal in most respects to those made from natural rubber. They are as good as natural rubber gloves in resistance to acids, and at the same time as grease and oil-resistant.

The company offers a tip on synthetic rubber gloves which have been packed for a long time and may look wrinkled and stiff on being unpacked. All their normal snap and life will reappear if they are held under warm water for a few minutes.

Industrial Pan Scale

A new Detecto-Gram Industrial Pan Scale has been added to the line of industrial weighing equipment manufactured by Detecto Scales, Inc., Dept. MF, 1 Main St., Brooklyn, New York. This scale is constructed on the time proven even balance principle with the reading dial at one end of the base, the commodity platter at the other end, and the weight plate in the middle. This permits all three vital points concerned with the weighing to be in direct line of vision with the operator, thus speeding up the weighing operation, and at the same time assuring a maximum of accuracy.

These Industrial Pan Scales are available without beams for direct weighing purposes where weights are employed. This model is also made up with one or two beams.

The tare beam which is used to account for the weight of the empty container is fitted with a small adjustment ball to permit the adjustment of the slightest fraction of an ounce.

Special dials are made for specific purposes, and a choice of five standard dials from 1 lb. x 1/100 lb. dial to a 1000 gram x 5 gram dial.

Scales are available at various capacities and the commodity platters are made up to suit specific needs.

Scales are in production and are available for immediate delivery.

Twenty-foot copper-pickling tank recently installed for a leading industrial concern. Tank is concrete, with lining of Tempered Plate Glass. The brick work in the bottom of the tank serves as a buffer between the material being treated and the glass tank bottom. Why not investigate GLASS for *your* tank needs?

PITTSBURGH GLASS!

GLASS TANKS by "Pittsburgh" are proving themselves real life-savers in many industries where production *must* go on.

For glass tanks are readily available. They are non-porous, non-absorptive. They are impervious to acids, alkalis, chemicals, liquids of almost every kind. They can even handle hot chromic acid!

The Pittsburgh Glass used in these tanks is specially tempered for strength and ruggedness. And there is a size and kind of Pittsburgh Tank to meet *your* requirements.

Here are some of the types now available:

1. Faced with glass inside and out.
2. Inner glass facing only.
3. Made of Carrara Structural Glass which is opaque and comes in a variety of attractive colors.
4. Made of transparent glass.
5. Glass linings for your present tanks, installed in your plant by "Pittsburgh" workmen.

Whatever your tank needs, find out about Glass Tanks by "Pittsburgh" today.

Write us, explaining your specific requirements. Pittsburgh Plate Glass Company, 2096-4 Grant Building, Pittsburgh 19, Pennsylvania.

"PITTSBURGH" stands for Quality Glass and Paint

PITTSBURGH PLATE GLASS COMPANY

New Chromium Development

Trivalent chromium, a long sought goal of scientists in the field of electroplating, has now become an established fact it is claimed. The new process and its radially different salt—on which patents are now pending—promises to revolutionize a manufacturing process in which basic improvement has long been static.

The Warner Process, with its new "Skalite" chromium salt, is claimed to provide substantially greater plating efficiency. Procedure for both hard and decorative chromium has been simplified. Plant investment is immeasurably less; the need for special chrome plating equipment has been eliminated. The Warner method is simple and automatic, not greatly different than copper plating.

Time, electrical energy and salts required are only 20% of the old process, it is stated. Due to the bath's non-gassing characteristics and substantially increased throwing power, there is no longer need for special contour anodes on intricate objects. The bath is also non-corrosive.

Constant testing of the bath by trained chemists is no longer necessary. Because workers experienced in plating ordinary metals can also handle this new chromium, labor costs are cut substantially. The new "Skalite" bath being non-poisonous, chromium plating is removed from the hazardous occupation classification—with attendant savings in liability insurance.

According to the developers of this new process—Warner Laboratories, Dept. MF, 360 N. Michigan Ave., Chicago—definite promise of being able to plate with chromium anodes and thereby controlling the crystal structure is indicated as a possibility of further research.

Emulsion Cleaner Concentrate

Pennsalt EC # 2, concentrate type emulsion cleaner comprising soaps, blending agents, and co-solvents for industrial grease cleaning applications, is soluble in water and in hydrocarbon solvents. It may be diluted with from 5 to 20 parts of suitable solvents such as low-cost kerosene, Stoddard solvent, or light fuel oil distillate. Uses suggested by the Special Chemicals Division of Pennsylvania Salt Manufacturing Company, Dept. MF, Philadelphia, Penna., the manufacturers, are—as an emulsifying solvent in removing carbonized oils, grease, smut, and drawing and buffing compositions. It finds use as a pre-cleaner, prior to electroplating, yielding a physically clean surface, and is also applicable to power washer and soak tank operations in water emulsion form or to increase the effectiveness of alkaline cleaners. The material also acts to inhibit rust formation. Packed in 55 gallon drums, it is available in commercial quantities.

Lead Plating Solutions

For the protection of iron and steel against corrosion and to obtain a corrosion resisting coating on non-ferrous metals, electrodeposited lead has been used to a limited extent for many years. The use of lead coatings as a substitute for more critical metals is increasing and may assume considerable proportions.

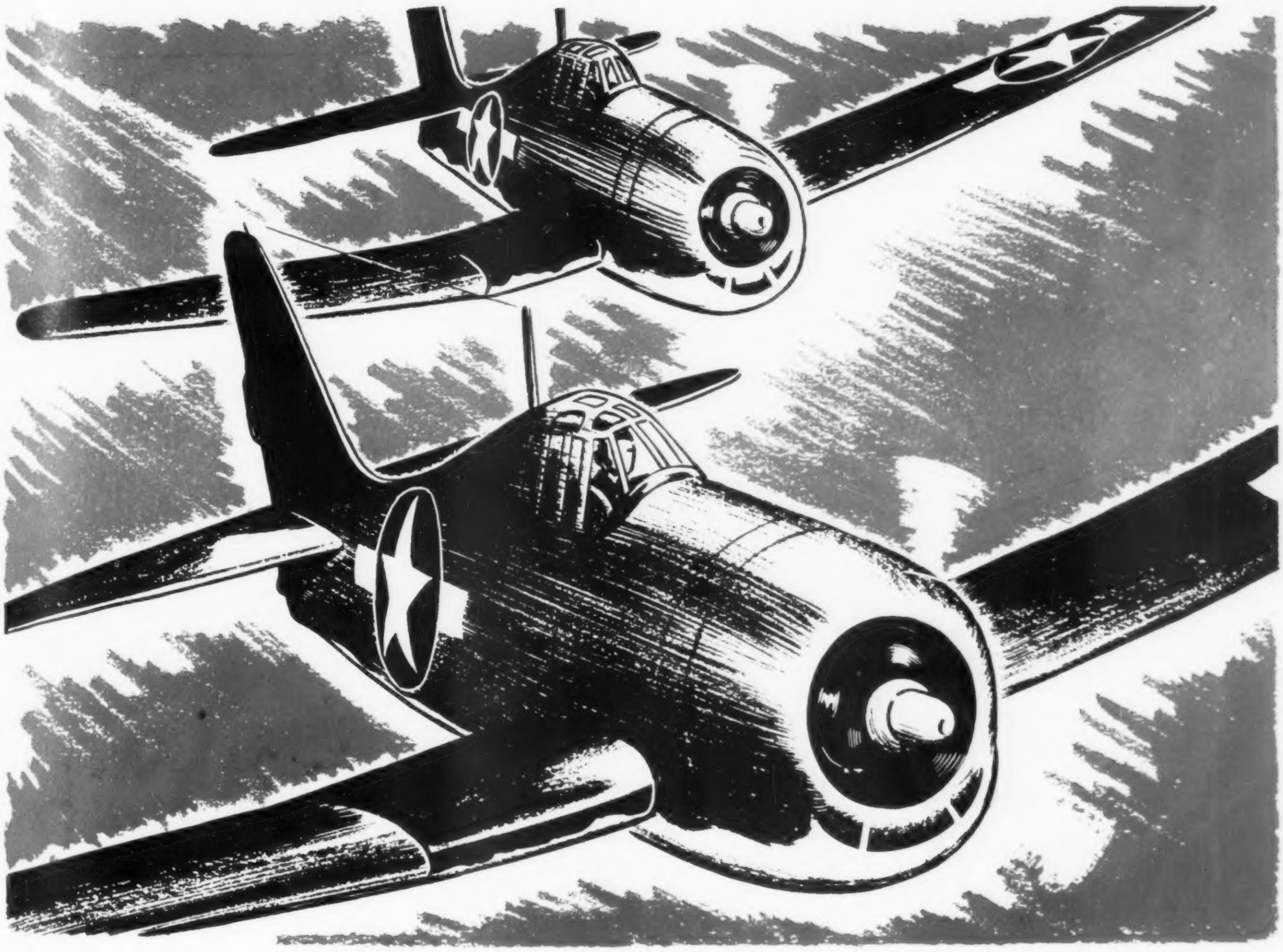
Through an extended laboratory investigation several lead solutions have been developed by the Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

Concentrated Protecto Lead Solution which has been sold for many years, is now substantially improved by recent changes in the formula. To prepare a working solution simply add three parts of water to one part of concentrate.

The resulting Protecto Lead Solution is for general purpose, plating at low to medium current densities. The plating range is from 5-15 amps/sq. ft.

Super Protecto Lead Concentrate is a well-balanced concentrate, to be diluted with equal parts of water to form an electroplating bath. It is a modern solution for general purpose plating. As the metal concentration of the working bath is 4 times that of the Protecto Lead Solution, the current density range is extended to 30 amps/sq. ft. or even higher with suitable agitation. The throwing power of this solution is also higher. This solution is recommended for barrel plating.

B-H Lead Solution. This solution is not concentrated but is used for lead plating as prepared. It is designed especially for lead plating bearing surfaces, and is being used by large aircraft motor manufacturers. This



solution is also excellent for general purpose plating.

The B-H Lead Solution produces deposits with the proper micro-structure for subsequent indium plating and heat treatment. Before the material leaves the manufacturer, samples plated in the solution are examined microscopically to make certain that the structure is correct and that the deposits are free from harmful inclusions.

Analytical methods and full instructions for the operation of these solutions are obtainable on request, from the Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

Synthetic Belting

Belting made with the new synthetic rubber from government plants, known as GR-S synthetic rubber can be joined to natural rubber belting with a vulcanized splice, it is announced by The B. F. Goodrich Company, Dept. MF. This makes it possible to use sections of the new GR-S synthetic belting to repair existing belting when needed.

The company's standard splicing and repair materials can be used with the new GR-S synthetic belting, using the same directions given in the B. F. Goodrich manual on repairing and splicing belting.

Business Items

J. Burke Tuthill has joined the Los Angeles laboratory staff of *Kelite Products Inc.*, to take up a research assignment in specialized applications of pH Control to metal processing and cleaning.

Mr. Tuthill, formerly an independent mining engineer, went to Kelite from the Utah Ordnance Plant of Remington Arms Co., where he had been working as Control Chemist since the start of the war.

The Pennsylvania Salt Manufacturing Company moved its New York Office on February 1st to 40 West 40th Street, New York 18, N. Y. The New York Office is the headquarters of two of the Company's sales districts, one headed by *F. G. Rodenburgh* and the other by *C. A. McCloskey*.

The Chicago Sales Office of the *Amercoat Division of American Pipe and Construction Co.*, Los Angeles, California, occupies new quarters in Suite 341, McJunkin Bldg., 4554 N. Broadway, Chicago, effective February 9. The move to larger quarters was announced by *R. A. Glasgow*, General Sales Manager, who will make his headquarters there. With *J. W. Staples, Jr.*, Amercoat Sales Representative, he will continue to serve industrial firms in Chicago and surrounding territory.

The Manderscheid Co., manufacturers of Buffing and Polishing specialties, are now located in their larger Office and Factory at 605 West Washington St., Chicago 6, Ill.

The Hauser-Stander Tank Company, Cincinnati, Ohio, manufacturers of Wood Tanks, are celebrating their seventy-fifth Anniversary.

The Tobler Chemical Co., formerly of Portland, Conn., are now located in their new plant at 28 Oliver St., Boston, Mass.

Thompson-Hayward Chemical Co. of Kansas City, Mo., have been appointed exclusive representatives on Griffin's Hytemp Protective Coating for all of the territory covered by their organization.

Wartime changes in procedures and materials, requiring constant revision of cleaning and processing methods in the metals and machinery industry, resulted in the appointment of *Dr. John M. Schweng* to the staff of *Turco Products, Inc.* according to an announcement made by *S. G. Thornbury,* President and Technical Director. Dr. Schweng will serve as chemical research engineer, and Director of Bacteriological

Research. He was chemical research engineer at Lockheed for 2½ years, and before that he was chief chemist at Imperial Laboratories in Los Angeles for three years. Dr. Schweng has to his credit advances in the catalytic cracking of petroleum crude, and in the development of protective coatings for aluminum and magnesium alloys. A member of the American Chemical Society, Dr. Schweng took his M.D. degree at the University of Chicago, from which university he also received a B.S. degree in chemistry.

Royal F. Clark, Sr., has been appointed plating supervisor of the *U. S. Naval Ordnance Plant* at Milledgeville, Georgia. He

has had 43 consecutive years of practical electroplating experience, and is the author of several articles on the deposition of metals

which were published in the "Metal Industry." In 1919, Mr. Clark was general foreman of Copper and Nickel Plating at the Columbia Phonograph Company, at Bridgeport, Conn., where matrices were made by copper plating upon wax masters in 1,880 copper plating tanks, and depositing one ton of copper every 24 hours.

Mr. Clark is a charter member of the American Electroplaters' Society, and was secretary-treasurer of the New York branch, Bridgeport and Newark branches, along with the job of presidency of the Newark branch.

W. D. MacDermid Chemical Co., Bristol, Conn., has announced the appointment of *Edward F. Berry Company*, 6432 Cass Ave., Detroit, Mich., as sales agents for the Kemtex and Ferrodex line of metal cleaners, in the state of Michigan.

Associations and Societies

American Electroplaters' Society

Pittsburgh Branch

At the February meeting of Pittsburgh branch, A. E. S., it was decided to hold a "Ladies Night" at the April branch meeting —Thursday, April 5th.

At this meeting no business will be transacted, and no papers read. The whole time will be given to the annual "ladies night."

A unique feature thereof has been decided upon by the up-and-coming members of this branch, particularly the associate members. In order that there may be no favoritism shown and no breaking up of the assemblage into cliques, groups or gatherings, the suppliers have gotten together to levy an assessment of $10.00 on each supplier. The sum thus collected will be spent for a cocktail hour to precede the dinner and continue throughout the evening.

The committee of the supply men who have shouldered the responsibility of furnishing the sustenance for the cocktail hour will consist of: *William J. Hennessey, Pennsylvania Salt Co.; J. L. Wray, Egyptian Lacquer; Richard Hummel, Harshaw Chemical Co.; Wm. A. Rodgers, Kolena Rodgers Co.; Wilfred S. McKeon, Sulphur Products Co.*

The live wire supply men are patterning their entertainment after the *International Fellowship Club's* Annual Convention's "Open House."

This group of the Pittsburgh branch has decided to apply to the International Fellowship Club for permission to organize their own Fellowship Branch "*No.* 1" of the International Fellowship Club.

They mean to have their own treasury and to carry on the affairs for the Pittsburgh branch on the same general lines as the International Fellowship Club does for the supreme society.

The officers of the Pittsburgh branch are: *President—Herbert Saylor, Cowan Manufacturing; Secretary—Frank Keller, Standard Steel Springs.*

In the "*Ladies Night*" meeting there will be plenty of entertainment. Moving pictures of the last two supreme conventions will be shown. But the stellar attraction for all those of the Pittsburgh district who know him, will be a violin offering by the American Electroplaters' Society's premier violinist, Mr. Herbert F. Saylor, President of Pittsburgh branch. Mr. Saylor has appeared around the world in the capacity of a violinist.

Jackson-Lansing Branch

The recently formed Jackson-Lansing Branch of the A. E. S., are making preparations for their first Annual Educational Session and Dinner Dance to be held May 13, 1944, at Jackson, Michigan.

New England Regional Meeting

The Sixth Annual New England Regional Meeting of the A. E. S. will be held Saturday, April 22, 1944, at New Haven, Conn. The Educational Session starting at 2 P.M. will be held in Strathcona Hall of Yale University. The Banquet and Dance will be held at 7 P. M. in the Ballroom of the Hotel Taft. The women's program includes tickets for the matinee performance at Shuberts Theater.

Los Angeles Branch

Los Angeles Branch of the American Electroplaters' Society will hold its annual educational session March 18 at the Los Angeles Breakfast Club. The program of speakers and their subjects is as follows:

"Aluminum Procedure," by *Roy E. Paine*, chief metallurgist, Vernon, Calif., plant of the *Aluminum Corp of America.*

"Plating of Large Aircraft Structural Parts," by *Manuel Sanz*, chemist and metallurgical engineer, *Consolidated-Vultee Aircraft Co.*, Downey, Calif.

"Summary of Report of the 1943 Buffalo Convention," by *R. P. Crane* of Waterbury, Conn., vice-president of the *Lea Manufacturing Co.*, at morning session.

"Burring Effect on War Materials," by *R. P. Crane*, at afternoon session.

"Availability of Strategic Metals for the Plating Industry," by *G. A. Joslin*, Los Angeles, representing the *Metal Reserve Corp.* of the War Production Board.

"New Developments in Equipment," by *John Raskin* of the *Udylite Corp.*, Detroit, Mich.

Arrangements are also being made to hold an exhibition of plated articles and other industry products. *Marcus Rynkofs*, head of *Liberty Plating Co.* of Hollywood, is chairman of the program and arrangements committee. The annual banquet and ball will be held in the evening.

Porcelain Enamel Institute

The Porcelain Enamel Industry Studies New Processes

Di-electric heating and induction heating for drying and fusing porcelain enamels are two suggested changes in porcelain enamel processing. These methods of heating may have revolutionary effects upon the application of porcelain finishes. Although such work has not been done previously, the importance in other fields indicate that such methods may be possible.

The use of multiple or repeat tanks in cleaning operations and electrolytic cleaning has been suggested. The technicians in this industry agree that better cleaning is important and point to the results which have been secured for other coating processes such as plating. The possibility of producing perfectly clean working surfaces on iron or steel sheets has been a matter of long development in the porcelain enamel industry.

Atmospheric control of furnaces is progressing with great rapidity, especially when the protective nature of the porcelain enamel coating is important. The manufacture of water tanks and other containers has been the proving ground for this important method of application. The surface produced seems to be completely free of the usual irregularities.

Air cleaning, both as a matter of process control and for the recovery of materials, is receiving increasing attention. The proper preparation of air for spraying improves the application of the coating. In the recovery of materials from spray booth exhausts, some processes reclaim almost 100% of the losses.

Electrolytic precipitation of porcelain enamels in spraying, according to many engineers, will result in large reduction in materials used. It will also make application much more complete and uniform, and tend to reduce the loss resulting from irregular or thick coatings. This process, already in use in other industries, is receiving extensive engineering study in the porcelain enamel industry.

The importance of research work in these fields has led the Porcelain Enamel Institute to establish a committee on process development to study new manufacturing methods and report on their adaptability to this industry. This committee consists of: Chairman, *L. E. Nordholt, Vice President, Tennessee Enamel Mfg. Co.*, Nashville, Tenn.; *H. D. Carter, Research Engineer, The Harshaw Chemical Co.*, Cleveland, Ohio; *R. M. King, Associate Professor, Department of Ceramic Engineering, Ohio State University*, Columbus, Ohio; *Edward Mackasek, Development Engineer, Porcelain Enamel Institute*, Washington, D. C.; *A. I. Andrews, Head of the Department of Ceramic Engineering, University of Illinois*, Urbana, Ill.; *J. W. Hoehl, Vice President, Wolverine Porcelain Enameling Co.*, Detroit, Mich.; *G. W. Dykstra, Engineer, Great Lakes Steel Corporation*, Detroit, Mich.; *R. E. Taylor, General Superintendent, The Enamel Products Company*, Cleveland, Ohio; *F. R. Porter, Engineer, Inland Steel Company*, Indiana Harbor, Ind.

News from California
By FRED A. HERR

E. R. Holman, chief chemist of *Turco Products, Inc.*, Los Angeles, left the first week in February for a month's business trip to points in the Middle West to study new developments in chemical and metal finishing procedure and to look into new installations and techniques. His itinerary included visits to St. Louis, Chicago, Cleveland, Detroit and Cincinnati. He arrived in Chicago in time to attend the annual banquet of Chicago Branch of the A. E. S.

Ernest Lamoureaux, one of the best known men in the electroplating industry both locally and nationally, was confined to his Los Angeles home for nearly a month during January and February with a severe attack of influenza. His many friends in the industry were cheered to see him make his appearance at the February meeting of the A. E. S. looking none the worse for his seige of illness. Mr. Lamoureaux, an honorary life member of the Supreme Society, is one of the mainsprings of A. E. S. activity on the West Coast. With a business career that spanned more than 40 years in the electroplating industry, and his wide acquaintance in the industry in the East and Middle West, he is an ideal liaison man for the Branch in contacts with Supreme Society officers and members in the East.

Calvin B. Morris, one of the veterans of the Southern California plating fraternity, has reestablished himself in business after a number of years' work with various independent shops. In partnership with *Walter A. Stallfort*, Mr. Morris is now operating the Long Beach Plating Co. at 2382 American Ave., Long Beach.

Their plant is equipped to do metal polishing, plating, lacquering, sandblasting and other operations, for which 3,100 sq. ft. of floor area are available. Mr. Morris reports he has installed two zinc, two cadmium and two anodizing tanks, in addition to several tumbling barrels and the necessary lathes, blowers, sandblast units and degreasers. Much of the work at present is on lath nails under sub-contract from the Phillips Co. of San Pedro.

From 1920 to 1925 Mr. Morris operated a plant in partnership with William B. Hancock in Long Beach. He then established the San Bernardino Plating Co. at San Bernardino, Calif., and operated it until 1930. Subsequently he saw service with the Crown City Plating Co. in Pasadena, the Liberty Plating Co. in Hollywood, and other firms.

"The Valuation and Interpretation of Magnaflux Testing" was the subject of an address delivered at the meeting of Los Angeles Chapter of the *American Society of Metals* by *C. E. Betz*, vice-president and technical director of the Magnaflux Corp. Mr. Betz was associated in the early development of the Magnaflux method, was chief chemist of the Pittsburgh testing laboratory for 22 years, and has been technical director of the Magnaflux Corp. for the past eight years.

Manufacturers' Literature

Coated Abrasives

The *Behr-Manning Corp.*, Dept. MF, Troy, N. Y., a division of Norton Company, has published a revised edition of their Basic Information Booklet. This booklet contains 28 pages of well written and well illustrated information on coated abrasives, their component parts, their manufacture, etc. Copies may be had by writing to Behr-Manning.

Protective Coating

George R. Mowatt Co., Dept. MF, 24-26 W. 40th St., New York 18, N. Y., has published a new leaflet describing Griffin's Hytemp Protective Coating. Copies may be had by writing to the company.

Inter-Communication

Talk-A-Phone Mfg. Co., Dept. MF, has published a new 1944 catalog which describes their fifteen different models of inter-communication. For copies please write to the company at 1219 W. Van Buren St., Chicago 7, Ill.

Factory Trucks & Trailers

A six-page edition (second edition) of a new industrial Handling Equipment catalog has just been released by *H. L. Pitcher Company*, Dept. MF, exclusive sales agent for the Rose Manufacturing Company, 12400 Strathmoor, Detroit, Mich. . . . It includes a description of a new model automatic dump hopper mounted on casters, four models of Heavy Duty (wagon type) trucks, sixteen miscellaneous models of steel boxes, baskets and platform skids, truck trailers and four models of Specific Purpose Trucks. Copies may be had by writing to the company.

Grinders and Buffers

An interesting 20-page catalog illustrating a complete line of grinders and buffers has just been issued by the *Queen City Machine Tool Co.*, Dept. MF, 252 E. Second St., Cincinnati 2, Ohio. This new catalog shows representative types of Queen City Bench, Heavy Duty Box-Type, and Pedestal Grinders; combination buffers and grinders; heavy-duty buffers; and disc grinders. These Queen City machines have a range of 1/3 H.P. to 10 H.P. in capacity. Complete specifications, prices and operating details of the various models are included in this catalog, which is available on request.

Chain Belt Care

"Wartime Care of Chain Belt Drives" is a booklet published by the *Chain Belt Company* giving information on maintenance, lubrication and repair of chain belt drives during these wartime days.

Chain belt drives, as well as other equipment, are working longer hours at a harder pace than ever before. The booklet was produced with the idea of helping users to get the most out of their existing drives and save some costly delays and unnecessary expense. It may be obtained by writing Chain Belt Company, Dept. MF, 1600 West Bruce Street, Milwaukee 4, Wisconsin.

The Nature of Foreign Deposits on Metal Surfaces

(*Concluded from page 147*)

Breakdown of larger deposits can with advantage be accomplished by the process of deflocculation, which is usually done with the assistance of colloids. The extra mass of these particles (although with the somewhat lower velocity) is preferable to the small mass of single molecules. The resulting force obtained on the impact of the colloidal particles against the mass to be disintegrated has a greater removal effect than when simple solutions are employed. The deflocculated material may itself become colloidal as a result of this bombardment and the colloidal particles thus formed will themselves assist in the breakdown of other solid masses. In this respect it has been noted that a degreasing solution is often more effective after a few days' running than when freshly made. In general, alkalis assist in deflocculation, whereas on the other hand acids tend to bring about coagulation.

Removal of Liquids

Here it is necessary to distinguish between superfluous deposits of liquid and adsorbed layers. The former can readily be removed by using a degreasing solution possessing a lower surface tension than that of the liquid to be removed. Emulsification may result in some cases, more particularly when the two surface tensions approximate to each other. The degree of stability of the emulsions will depend upon the presence of surface active materials and their ability to arrange themselves permanently or otherwise at the oil-solution interface. Permanent emulsions are naturally better from a degreasing point of view, since later breakdown of the emulsions will result in an oil film covering the top of the degreasing solution, a film through which the metal must be withdrawn. In this respect it has been noticed that it is possible to employ surface active agents in the degreasing solution in such a way that the aqueous film which replaces the oil film in the degreasing will withstand further coating by the oil when the metal is drawn through a film of the latter. In other words, although the metal appears temporarily

coated with oil upon removal, this is immediately rinsed away by water. The degree to which a solution can continue to form stable emulsions of oil is naturally limited and ultimate breakdown of the emulsion and even its reversion may occur when the balance becomes too greatly disturbed. Solvent action upon oil must be considered under the heading of liquids, and this may be either solvent action in aqueous or in organic liquids. For example, chemical action of alkalis on fatty oils will result in the formation of soluble soaps, which, apart from being easily removed, are also themselves somewhat surface active.

The removal of the adsorbed layer is more difficult; it will be left undisplaced from the metal surface unless the surface active detergent can create a stronger adsorption force with the metal than that of the adsorbed layer. Solvents will often remove an adsorbed layer, but this is merely replaced by one of the solvent itself and in subsequent processing this may often prove very detrimental. Organic solvents in particular suffer from this defect and troubles have arisen as a result of this in subsequent treatment in aqueous solutions, as, for example, the electroplating of work. If the surface active agent employed in an aqueous solution is too effective it may also prove difficult to remove in subsequent rinsing and give rise to similar difficulties to those of the adsorbed organic film in subsequent processing.

Removal of Gases

Air displacement is usually easy if a solution of moderately low surface tension is used or if mechanical agitation of the solution is employed. In this connection jetting is particularly effective. Adsorbed gaseous layers generally on the whole, present little difficulty for the reasons already given, but it should be noted that adsorbed hydrogen produced during electrolytic degreasing, the work being cathode, may be troublesome to remove. Heat may be used to reduce such adsorbed gaseous residues. It should be remembered that a clean metal surface will always become immediately coated with something, that something depending upon the relative adsorption forces of the materials in the immediate vicinity, whether they be gas, liquid or solid.

Obituaries

Oscar E. Servis

Oscar E. Servis, well-known Plating executive, died February 9, 1944, in Chicago.

Mr. Servis was born in Sweden on December 1, 1877. He came to the United States when he was a young boy. He studied chemistry nights and started in the business of metallizing roses. He later entered the employ of Felt & Tarrant Mfg. Co., Chicago, Illinois, and served them faithfully for over 40 years until he was forced to retire due to illness.

He was a charter member of the Chicago Branch of the American Electroplaters' Society and also served as Supreme President in 1919. At the A. E. S. Convention at Buffalo in 1943 he was elected to honorary membership, an honor which he treasured most highly.

Mr. Servis is survived by his wife Emma, daughter Ellen, and grandson Eugene.

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AMERICAN ELECTROPLATERS' SOCIETY
JUNE 12-13-14
HOTEL CLEVELAND, CLEVELAND, OHIO

Walter H. Hallsteen

Walter H. Hallsteen, age 53, Vice-President and Treasurer of the Ilg Electric Ventilating Co., Chicago, Illinois, died January 15 at St. Francis Hospital, Evanston. A graduate of Armour Institute (now Illinois Institute of Technology) in the class of 1914 with a degree in mechanical engineering, Hallsteen joined the Ilg sales staff in 1916.

During World War I, after successfully serving in the Sales Department, Hallsteen was brought into the factory office and made an assistant on purchasing. Shortly thereafter he was promoted and placed in charge of the Purchasing Department where he continued up to the time of his death.

As years went by, additional responsibilities were given to him until he arrived at the post of Vice-President and Treasurer of the Company.

Outside of the office, Hallsteen made a mark in purchasing circles. As a long time member and past President of the Chicago Purchasing Agents Association, he handled many of the arrangements for the Annual Purchasing Agents Informa-Shows. National recognition was bestowed upon him with his election as District Vice-President of the National Association of Purchasing Agents.

In addition to his business activities, Hallsteen played a leading civic role in his home suburb of Kenilworth.

MARCH, 1944

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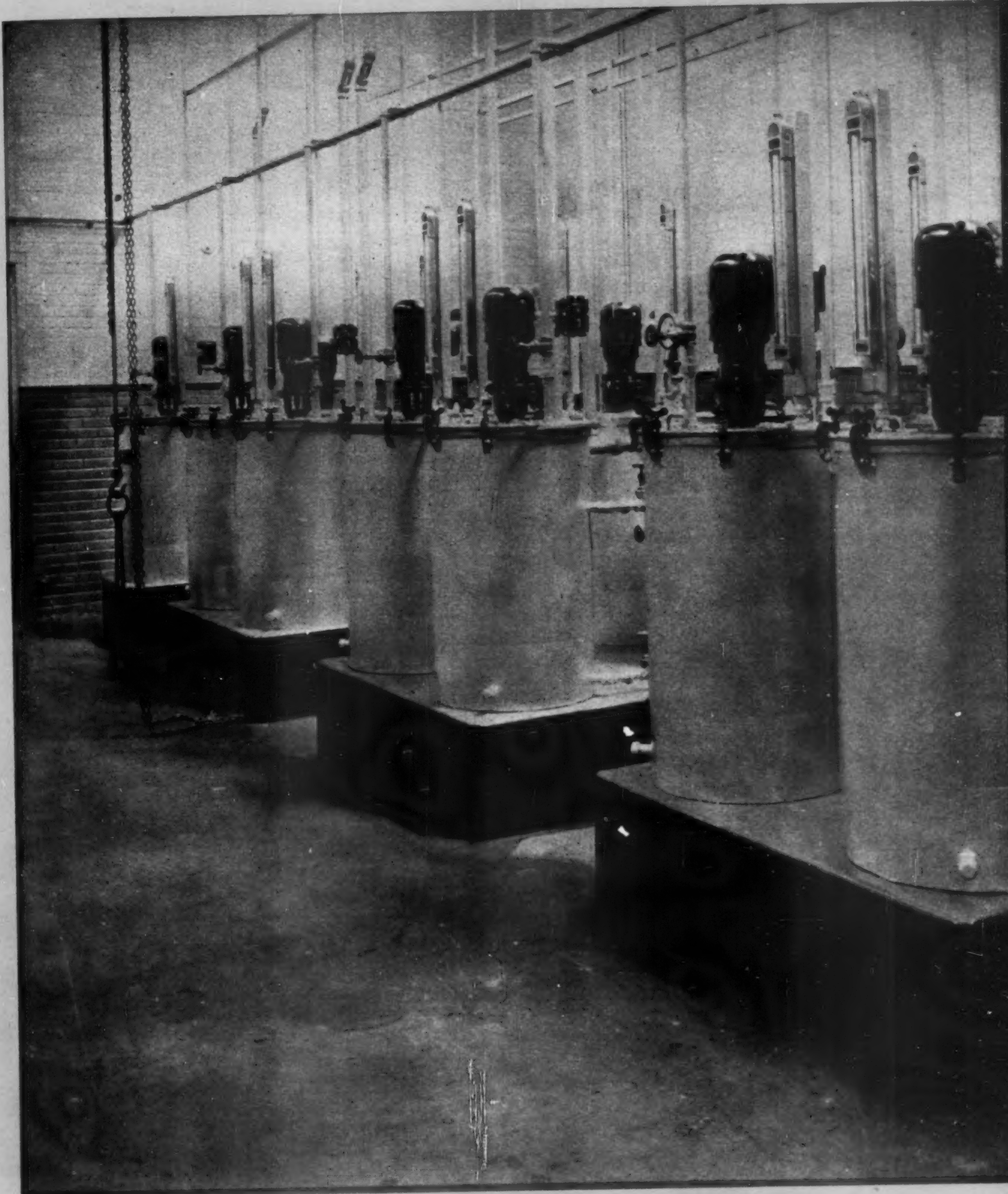

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MARCH, 1944

CONTENTS

Organic Finishes and Finishing in Wartime — By Charles F. Rohleder **177**

Dip Tank Construction and Operation **183**

A Tumble Finishing Questionnaire — By Rufus J. Fairburn **189**

News from Washington **175**

New Equipment **192**

Manufacturers' Literature .. **194**

Patents **195**

Business Items **198**

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Cover Photograph

Central dispensing room for finishing materials showing motors, pumps, inter-tank connections, etc. of the system. *Courtesy Binks Mfg. Co., Chicago, Ill.*

Diversion of Industrial Solvents

It has been reported that appreciable quantities of petroleum solvents and coal tar solvents are being diverted to supplement automobile gasoline rations issued by the Office of Price Administration. In addition to being unpatriotic and illegal, this practice can do much harm to the finishing industry as a whole and also to its individual members.

As we all know, many finishing materials employ solvents made from the same materials which produce gasoline. There is available in the United States only so much solvent and gasoline producing and processing equipment and transportation and storage facilities. A very definite part of these must go directly for the use of our armed forces. The remainder is portioned between industry and use in automobiles and trucks. It can be seen that diversion of any great amount of solvents from industrial uses immediately upsets the careful balance which has been set up between war, production and civilian requirements. Since the Army and Navy must have fuel for planes, tanks, trucks and other military and naval units, any loss has to be carried by either industry or civilians.

We do not wish to imply that the finishing industry is entirely responsible for any diversion of solvents which has taken place. Petroleum and coal tar solvents are also used in other industries. However, many solvents used in finishing materials can be used as a more or less satisfactory motor fuel and it is possible that some of these may have found their way into gasoline tanks.

We wish to point out that if any of the diversion of solvents mentioned is occurring in the finishing industry, it must be stopped. We have too much at stake in this war. To sacrifice any part of our war effort for a few more miles of automobile driving does not show very good judgment or sense of values. From a purely practical standpoint, use of such solvents as a motor fuel may result in serious damage to automobile motors. We said that solvents could be used as a more or less satisfactory gasoline substitute. Usually they are much less satisfactory, so much so that motors may be permanently ruined. If we may be facetious for a moment, it might be a good idea to contact the local Office of Price Administration to determine if a particular solvent is suitable for use as a motor fuel before it is used.

L. H. LANGDON, *Publisher* • WILLOUGHBY G. SHEANE, *Associate Editor* • T. A. TRUMBOUR, *Business Manager*

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NEWS FROM WASHINGTON–

By George W. Grupp

METAL FINISHING's Washington Correspondent

Use Revised Form and Save Time All those who normally applied for priority assistance on form WPB 541 (formerly PD-1A) for the acquisition of equipment or materials other than controlled materials must now use the new revised version. The WPB has refused to honor the old forms since February 1, 1944.

Acetic Restrictions Eased Allocation Order M-243 as amended January 15 1944 provides for an increase from 480 pounds to 5,000 pounds of acetic anhydride, acetic acid and acetaldehyde which may be delivered by any one supplier in any calendar month without specific authorization.

Alcohol Demand Increasing Due to the increasing demand of alcohol the WPB announced on February 10, 1944 that there might be a tightening up of end uses of alcohol. To conserve ethyl alcohol supplies it is planning to recommend the use of methyl alcohol wherever possible.

Alkyed Resins Shortage Imminent A representative of the WPB's Chemical Division on January 21, 1944 told members of the Domestic Cooking Appliance and Heating Stove Industry Advisory Committee that a shortage of alkyed resins is imminent because of the great demand for these chemicals as protective coatings on guns, tanks, ships and other military materials. Committee members were asked to make suggestions on the possible use of a substitute synthetic finish.

Flake Bronze Powder Removed from Copper Definition Copper Order M-9 was amended on February 11, 1944 for the purpose of removing flake type bronze powder from the definition of copper and copper-base alloy powders.

Carbon Tetrachloride Under Full Control Carbon tetrachloride was placed under full control on February 1, 1944 through the issuance of Allocation Control Order-363 on January 15, 1944. This order, however, excludes from its restrictions those distributors who sell this chemical in quantities of a drum 700 pounds or less per month to each customer. Deliveries to customers ordering 7,000 pounds or more of carbon tetrachloride in any one month must be individually authorized. Deliveries to customers ordering between 700 and 7,000 pounds per month will be authorized on the basis of end use.

Chrome Pigment Production in India The Premier Chromate & Chemical Works, Ltd. of Bombay, India is now manufacturing a wide range of chrome pigments. They include lemon chrome, middle chrome, orange chrome, and chrome green. The company also manufactures sodium and potassium bichromates.

Chromium Pigments Under Control Since there is a critical shortage of chromium chemicals Order M-370 was issued on January 21, 1944 to bring chrome pigments under control. This order puts chromium oxide green and zinc chromate under complete allocation control. Other chrome pigments like chrome yellow, chrome green, chrome orange, molybdate chrome orange and hydrated chrome oxide are limited to 25 per cent of a user's aggregate purchase of these pigments in 1941. This new order will assure adequate supplies of chrome pigments for military uses such as for camouflage and metal corrosion preventive purposes.

Enameled Containers Price Coverage The Office of Price Administration issued Amendment No. 1 to Maximum Price Regulation No. 350 to enable producers of packers' tin cans who sold containers coated with special enamels developed since October 15, 1941 to apply to the price agency for a maximum price for such cans.

Enamel Wire Naptha Under Full Control Enamel wire naptha was recently placed under full allocation under the provisions of Miscellaneous Chemical Order M-340. This action was necessary because the outstanding AA-1 rated orders call for twice the available supply of this critical chemical. Orders for 54 gallons or less, however, may be delivered by a supplier to a customer in one calendar month without special authorization.

Ethyl Alcohol Order Clarified Allocation Order M-30 on Ethyl alcohol was amended on February 3, 1944 for the purpose of clarifying the original provisions of the order. The small order exemption was rephrased to make clear that purchasers may not acquire the maximum small order of each alcohol type. It is limited to one type.

Ethyl Alcohol Warning Issued The WPB on February 14, 1944 issued a warning to ethyl alcohol purchasers against misinterpretations of allocation Order M-30 as amended on February 3, 1944. The warning announced that small orders of 7,900 gallons per quarter is not exempt from the restriction of the order. The 7,900 gallon figure is a quantity limitation concerned solely with the methods of obtaining delivery.

Phenolic Resin Restrictions Eased General Preference Order M-245 was amended on February 15, 1944 to clear the way for purchasers to use up to 200 pounds of phenolic resin or phenolic resin molding compound per month for any recently authorized end use, without specific authorization from WPB.

Resin Restrictions Will Not Be Lifted Essential resin gums, chiefly soluble copal, hiroie, and rassag, are now becoming available in New Guinea and other parts of the Far East the members of the WPB's Natural Resins Importers' Advisory Committee were told. Members of the committee asked the WPB that such gums be placed under General Order M-63 so that shipping quotas can be established. This is not likely to be granted because it is known that the Army is opposed to the resumption of civilian activity in newly recaptured territories for it believes it might divert local manpower and transport from essential military activity.

Swedes Establish Research Laboratory Recently a number of Swedish paint and varnish manufacturers established the Swedish Paint and Varnish Industries Research Laboratory which will conduct technical and scientific research on paints, varnishes and lacquers in cooperation with the Royal College of Technology.

Trichlorethylene and Perchlorethylene Under Allocation Trichlorethylene and perchlorethylene, which are used in degreasing metals, were placed under control by the issuance of Allocation Order M-371 on February 11, 1944. Allocations were established for all producers and distributors except those distributors who sell these two chemicals in quantities of 52-gallon drums (770 pounds) or less per customer per month.

Turpentine and Resin Situation in U.K. The latest reports from the United Kingdom reveal that its turpentine and resin market continues to be regulated by the supply situation. All available amounts are quickly absorbed by the paint and other industries. There is no distribution of raw materials except to priority users.

Organic Finishes and Finishing in Wartime

By CHARLES F. ROHLEDER

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AT the present time, painting for purely decorative purposes has been pushed to the background and organic coatings have come to the front for their corrosion resistance and protective properties. Color enters the picture, of course, not from an artistic point of view but rather for identification and the all important art of camouflage, which will be discussed a little later.

Combating corrosion always has been a great problem. Today the problem is more important than ever. Tanks, trucks and other military equipment distributed all over the world and exposed to every type of weather would not last very long unless protected by a good organic finishing system.

Specification Finishes

Bombs, ammunition and other war items must have a complete and well proven coating because they are often required to lay for some time in field dumps with little or no protection. That is why organic coatings must meet certain specified laboratory tests such as flexibility, hot and cold water immersion and accelerated weathering tests. Both the Army and Navy have specifications, developed through years of experimenting and testing under actual conditions. When we first entered the war, defense work was greatly hampered by obsolete finishing specifications. Having different specifications from various departments for the same work was a great burden to the manufacturer and finisher. It meant having two or more materials on hand to do the same type of work, one for the Army and one for the Navy. This situation has been materially rectified and we now have many combined specifications which can be used for either Army or Navy work. Inasmuch as the performance requirements are the same for the Army and Navy on many materials, manufacturers and finishers are hoping for more joint specifications.

Allocations, etc.

As the need for more organic coatings for our war production increases, less raw materials will be available for non-essential civilian production. In fact, today almost all of the raw materials for organic coatings are available for war work only. The balance is gradually being diverted to war uses. Therefore, a manufacturer who is not engaged in the war effort in some capacity is faced with an extremely dark picture. No one has much available material with which to supply him, due to WPB, M and L conservation or allocation orders. These direct the use and distribution of critical materials. Examples of these are M 56 on natural resins and M 254 and M 139 which control para phenyl phenol and alkyd resins. Limitations orders, designated by the letter L, place a limitation on the manufacture of items, the production of which reduces the supply of scarce materials. The best known of these is the L 113 order on pencils which not only states that no metal is to be used in their manufacture but also specifies that only one gallon of coating material per hundred gross of pencils may be used for finishing. The order also permits the use of only certain available pigments in pencil coatings.

Although there are still some materials available for non-essential finishing, the supply is rapidly diminishing. As fast as new ones are found those which have outstanding characteristics are either diverted to the war effort or the materials from which they are made become critical. All of this research work has not been a total loss in time, money or effort because many new products and substitutes of merit have been found. These, of course, will remain after the war.

Organic finishes and coatings are made from hundreds of raw materials such as synthetic resins, natural resins, drying and non-drying oils, plasticisers, cellulose derivatives, chlorinated rubber, pigments, driers and solvents. In the manufacture of synthetic resins such chemicals as urea, formaldehyde, maleic anhydride, phenols or phenol derivatives, polyhydric alcohols, modifying oils, sebacic acid and many other materials are required. Most of these are now controlled under allocation or M orders and specific permission for their use must first be obtained from WPB.

When M 56 first appeared, natural resins were pretty well tied up, but restrictions on a few of them have been eased somewhat. Although most natural resins come from the East Indies, Singapore and the Malayan States, it was found that stocks on hand would probably last for another five or six years. This has helped tremendously to ease the pressure on synthetics. The different government agencies have been prevailed upon, by the synthetic resin manufacturers themselves, to revert to the old type natural resin finishes which had been replaced by synthetics. Thus far, not too much success in this endeavor has been obtained. The government agencies and ordnance departments, after listening for years to the claims for synthetic resin coatings—and after actual tests have shown their merits, are hesitant to return to the old type finishes. Actual performance has proven the superiority of synthetic resin finishes.

Today most protective coating manufacturers have converted their plants to some type of war work. As was mentioned before, materials are available for this work. It is, of course, necessary to have a sufficiently high priority rating or an important ultimate end use to obtain the required materials. Ultimate end use or final product on which the material is to be used is the all important consideration today and it is the responsibility of the user of organic coatings to supply the manufacturer with ultimate end use information so that raw materials may be obtained. As the supply of raw

materials decreases, higher priority ratings and better ultimate end uses are needed to purchase finishing materials containing these scarce materials. Some materials, such as tricresyl phosphate, aluminum powder and toluene are available only under direct government order. For instance, tricresyl phosphate is only to be used in cable coatings because of the fireproofness and flexibility which it imparts to such coatings. Another example is the M order on castor oil which prohibits its use on anything but "implements of war." Many discussions arose as to a definition of "implements of war." Now the generally accepted one is that if it shoots, swims or flies it is considered an implement of war.

Replacement Finishes

Let us discuss briefly some of the finishes which have been developed as war time replacements. Metallic finishes, containing aluminum powder, were very popular and were used on everything from compact cases to heavy industrial equipment and machinery. Since the restriction on aluminum powder (which incidently, was the first "M" order, "M-I"), many manufacturers offered finishes containing pearl essence. Very fine results were obtained, some with one coat and some with two coat systems. The one coat pearl essence finish usually consists of a mixture of clear lacquer plus pearl essence and pigments. The two coat finish consists of a ground coat of desired color plus a top coat of clear lacquer containing pearl essence, with or without transparent colors. While the finish does not have the metallic brilliance of aluminum powder finishes, a much softer and, to some people, a more pleasing effect resulted.

When chemicals and metals became scarce for plating, a demand arose for simulated metal finishes. Colored transparent lacquers and synthetics were used, both air drying and baking. These are sprayed over highly polished steel or other metals giving results which simulate brass, copper, gold and other metals. When this work first started requests even came in to simulate brass over wood and black iron. This, of course, was very difficult because the brilliance of the finished product is directly dependent on the brilliance or gloss of the metal base.

Zinc Chromate Primer

A material which is of great importance today is zinc chromate primer. The moisture inhibiting and protecting qualities of zinc chromate have been known for years. In fact, the Navy early recognized this and was instrumental in making zinc chromate primer as popular as it is today by their research and development work. Today, the Navy requires a thin coat of zinc chromate primer P 27 on all their work before any other materials are applied. The specification has very rigid tests which the material must pass, one of the most severe of which is the settling test. When reduced by the addition of three parts by volume of toluene to one part by volume of zinc chromate primer and allowed to stand 24 hours in a glass graduate, there shall be no evidence of distinct separation of pigments from vehicle. All pigments shall be completely replaced in suspension by shaking the graduate for not more than 30 seconds.

P 27 was used for many years by the Navy. The Army also had a zinc chromate primer, No. 14080, issued June 5, 1936. This specification had the same performance requirements as P 27 but the manufacturer had much greater latitude in formulation. In July, 1941, under the government plan of consolidation and simplification of specifications, AN-TT-P 656 was issued which was applicable to either Army or Navy work and superseded P 27 and 14080. This was a concession on the part of the Navy which lasted for a short time. Suddenly the industry was informed that the Navy was returning to P 27 zinc chromate primer for their work. The Navy felt that P 27 had proven itself under actual performance and did not feel that any chances should be taken on a material whose ingredients were not known.

All of this gives some idea of the changes that occur in specifications. Previously it was mentioned that pressure was brought upon government officials by manufacturers to go back to the old type natural resin finishes to relieve the demand on synthetics. The justification for this action was the fact that most equipment is repainted in six months or else has been used up or destroyed before that time. Why put a finish on equipment which would more than outlast the anticipated life of the equipment?

Aeronautical Finishes

Now let us look briefly at the reasons for some of the Government Aeronautical specifications. It was only a few years before the present war that aeronautical engineers became interested in flying conditions at 30 to 60 thousand feet. With these greater heights, increased problems arose for the aircraft engineer. A finish that stood up well at 3000 feet was found to be absolutely useless in the stratosphere. Today the finish on aircraft and flying instruments must be able to stand the heat of the steaming jungles of the tropics and also the clear, dry cold of the stratosphere. Insulating varnishes and coatings had to be made for radios and equipment which would retain their insulating properties and flexibility at low temperatures. To help solve these problems, engineers have constructed testing chambers where stratospheric conditions can be maintained and tests conducted. Close cooperation between the engineers and organic coating chemists has resulted in solving many of these problems. As planes reach higher and higher altitudes, conditions for tests change. These conditions are reflected in the modern units which, to meet certain specifications, require altitudes as high as 60,000 feet, temperatures as low as 70° below zero, heat as high as 160° above zero and humidities up to 95%. Suitable finishes and new products for these conditions are being worked out every day.

Our bombers and metal planes require first a primer which is capable of inhibiting corrosion and also acting as a bond between the bonderized or anodized metal and subsequent coatings. Of course, as previously mentioned, both the Army and the Navy are using zinc chromate primer. An important point to remember when applying zinc chromate primer is that it is most effective when applied in a thin, wet, almost transparent coat. A heavy coat will usually fail to dry properly and will offer no added protection. The chromate primer is followed by one or two coats of lacquer or synthetic enamel. Cellulose nitrate lacquers fortified with glyceryl phthalate resins are commonly used. Both the Army and Navy specifications include glossy and nonspecular or lustreless lacquers and enamels.

Fabric Finishes

Finishes for fabric covered planes must not only protect the fabric against the action of the sun and rain but must also strengthen and pull the fabric smooth and tight. For this purpose clear, semi-pigmented and pigmented lacquers or dopes are used. These materials are made with both cellulose nitrate and cellulose acetate. Due to the flammability of nitrocellulose, cellulose acetate is used more and more, even though greater difficulties are encountered in formulation.

As a general rule, fabric planes are finished first with two brush coats followed by two spray coats of clear or semi-pigmented dopes. After an overnight dry, two additional coats of either gloss or lustreless pigmented dopes are sprayed on. Insignia and identification marks are applied by spraying through stencils or by transfers. Regular dopes and lacquers are used for spraying these. The Army and Navy have porcelain plates as aircraft color standards. Color schemes are dependent upon locality and use. Navy planes usually have a blue gray top surface and a light gray under surface. An Army plane might have an olive drab top surface and a neutral gray under surface.

Some typical Army-Navy Aeronautical specifications are as follows:

AN-TT-D 551—This is a clear NC dope, either for brushing or spraying, and to be used as first coat on fabric planes.

AN-TT-D 556—This is a semi-pigmented NC dope intended for finishing fabric planes.

AN-TT-D 554—This is a fully pigmented NC dope used on fabric planes.

AN-TT-L 51—This is made in 17 or 18 different colors and intended for use as an exterior protective coating over zinc chromate primer.

AN-TT-P 656—Zinc chromate primer for either Army or Navy.

AN-TT-T 256—Thinner for AN materials.

Plywood Finishes

Because of metal shortages, many planes, especially trainers and gliders, are made of plywood. Extensive work has been done on plywood finishing and testing of plywood finishes. Plywood needs a finishing system which will give maximum resistance to rain, snow, heat and cold with a minimum number of coats. It must also be fungus or moldproof. Some systems use the old method of fillers and pigmented surfaces, followed by a top coat enamel of an approved color. The current trend, however, is toward clear sealers followed by one or two coats of a specification material such as U. S. Army Air Corps 14109.

Camouflage

Tanks, trucks, large guns and automobiles for the Army must not only be protected from corrosion but must be camouflaged from the eyes of the enemy. The Holabird Motor Base, U. S. Army Ordnance Specifications ES 680 A apply in this case. The ES 680 A specifications materials are government approved materials for almost every purpose. The lustreless olive drab enamel is a color of low visibility and non-specular reflection. It must retain these properties and should not polish when rubbed. The primer is a zinc chromate and red oxide combination which meets ES 680 A Class 101.

One of the most important problems of this war is the work of the camouflage section of the U. S. Army Engineers at Fort Belvoir, Va. They must make equipment, roads, bridges, installations, landing fields and buildings appear to be something else or conceal them entirely. For this purpose they use camouflage nets, wire screens, leaves, branches and, most important, paint. A paint had to be developed which could be applied easily, transported readily and thinned with water. The material had to be fungus proof, fade proof, fire proof and had to have good covering. The answer was found in emulsion paints of which enormous quantities have been supplied by paint manufacturers.

Another need arose where wartime equipment such as trucks and planes had to be concealed for short periods. The requirements for army equipment was that a plane on landing was to be given a quick coat of paint over the regular finish and then had to be easily removable with a garden hose spray or washed off with cheap solvents. This problem was also worked on by paint manufacturers. While some materials have been developed for this purpose, a great deal of work is still being done on improvements in this material.

After camouflage work was begun, it was realized that something more had to be done. When landing fields were first camouflaged by painting runways the same color as the surroundings, it was discovered that infra-red films used in aerial cameras gave pictures which made these runways stand out like black lines. Paints and lacquers having the same infra-red reflectance as the surrounding country were developed. Today, many specifications carry an infra-red reflectance clause which must be met. The only drawback is that, as seasons change, the infra-red reflectance of these paints and lacquers must be changed. All these conditions have been met by paint and lacquer chemists who are ready to cope with almost any problem which may arise.

Luminous Paints

We might mention luminous paints as a wartime finishing material. There are two main groups of luminous paint. The first group consists of radio-active materials which, through slow disintegration, emit short wave emanations which, incidentally, are injurious. The second group consists of fluorescent and phosphorescent pigments. The fluorescent pigments have to be activated by ultra-violet or "black light" and are only visible while activated. This type is commonly used on the dials in the cockpit of a plane. The pilot turns on the "black light" and the dials become visible. As soon as the light is turned off, nothing is visible.

Phosphorescent paints, when subjected to bright light for a short time will glow in the dark for several hours before fading. This is the type used in the subways and buildings and on street curbing in "blacked out" London. After one's eyes become accustomed to the darkness, which incidently requires about one-half hour, objects outlined with phosphorescent paint are easily discernible. Several colors are available, the bluish-white of activated strontium sulfide being the best and most popular. Activated zinc sulfide gives a greenish-yellow glow while activated calcium sulfide gives a purple glow.

The dimout regulations on the Eastern seaboard have created some demand for blackout paints and lacquers. These are of various types from the cheap water paints and cold cut

(*Concluded on Page 187*)

DIP TANK CONSTRUCTION and OPERATION

All operations involving the application of organic finishing materials present the possibility of fire and explosion. Particular care must be taken in the construction and operation of dip tanks because of the usually large volumes of finishing materials employed. This article presents the regulations for dip tanks of the National Board of Fire Underwriters as recommended by the National Fire Protection Association. The information contained is particularly important today when finishing room fires and explosions must not occur to cripple any part, however small, of our war production facilities.

—Ed.

1. The use of tanks containing highly flammable liquids, subject to flashing at ordinary temperatures and giving off flammable vapors and possibly vapors forming explosive mixtures, presents a severe fire hazard. Manufacturing requirements in some industries involve extremely large tanks there being often three or four of them in a single room each having a capacity of possibly 10,000 gallons used in connection with large ovens or dryers also subject to fire and explosions. The mixtures found in dip tanks may include various amounts of naphtha, benzine, benzol, amyl acetate, bisulphide of carbon or alcohols, which represent the principal flammable liquids. Of a slightly less hazardous nature are tanks containing paints, turpentine, kerosene, heated asphaltum, paraffine and tempering oils. Tanks containing mixtures with more or less benzine, naphtha and alcohols represent a large majority of those in use.

2. The principal danger from solvent vapors lies in the fact that most of them are heavier than air and settle in low places, especially in the corners of rooms where air may not circulate. There may be nearly pure air 5 or 6 feet above the floor of a room, while for some distance upward from the floor there may be a naphtha vapor mixture too rich to explode. Somewhere between the low lying rich mixture and the purer air above, there is the exact mixture to make possible an explosion. Exact measurement of evaporation as compared with the cubical contents of a room cannot therefore determine whether such a room is safe. It is essential that means be provided to prevent the accumulation of heavy vapors at low points in the room and the light vapors at ceilings.

3. Heavy vapors can be usually drained to the outside of the building at the floor level. Light vapors above may be passed to outside through ventilators. Usually a moderate circulation of fresh air will insure safe operating conditions by preventing the accumulation of vapors. Elaborate ventilating systems are not necessarily required but some conditions call for ventilation by fans. It should be recognized that such systems represent a fire hazard in themselves.

4. Samples of mixtures taken from dip rooms of various industries have shown on test very few cases where the ratio of the liquids evaporated had reached one part in 100,000 cubic feet of air, showing that the fairly good fire record is due to the fact that the mixtures in the average workrooms do not approach the danger point. Samples of air tested often showed richer mixtures in passages and corridors leading from the dip rooms than in the dip rooms themselves, indicating that air currents from the process room should be diverted to outside rather than to other adjoining rooms of the building. Any source of flame, sparks or moderately severe heat may cause fires in these locations, the fire record clearly showing that hot bearings, friction, static electricity, lighting, electric apparatus, matches and other common causes have started most of the fires.

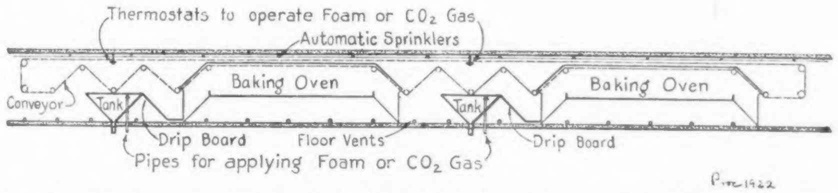


Fig. 1—A chain conveyor system of dipping with series of tanks and drying ovens. Conveyor interferes with the use of automatic covers, so automatic protection is essential. This diagram also represents the principles involved and does not show details. Foam or carbon dioxide piping and outlets must be especially designed for each case. Foam outlets are ordinarily near the liquid surface as shown, carbon dioxide outlets at some distance above.

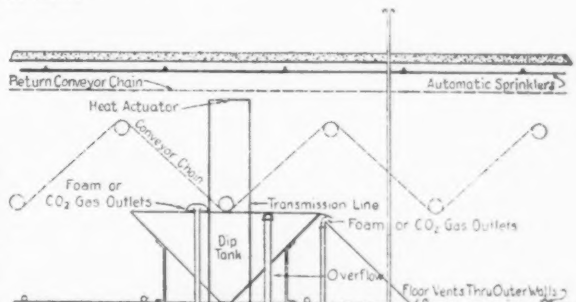


Fig. 2—Details of one of the tanks shown in Fig. 1. These tanks sometimes hold as much as 10,000 gallons of highly flammable dip. This diagram only represents the principles involved and does not show details. Foam or carbon dioxide piping and outlets must be especially designed for each case. Foam outlets are ordinarily near the liquid surface as shown, carbon dioxide outlets at some distance above.

5. The fire hazard in such dipping processes is extreme in any case as the nature of the compounds in the dip tanks is such that a fire in them produces serious results. Even if the room is fire-resistive and contains no other combustibles the heat from the burning compounds will ordinarily cause a severe loss to the most superior construction and incombustible stacks, and even complete destruction has sometimes occurred. Such a fire will distort, with large loss, unprotected steel work and machinery in the room, as well as cause a heavy damage to the other contents.

The smoke and gases from such fires are usually very heavy, making fire fighting difficult and dangerous. Therefore, some automatic means for prompt extinguishment is essential.

6. A dip tank on fire will burn for a long time because only the surface area of the liquid is usually involved.

A tank containing an ordinary mixture two feet deep would probably burn fiercely for two or three hours. The only way to extinguish such a fire is to smother the burning surface promptly. If too much water is applied tanks will overflow and the burning volatiles will flow around the room and wherever the water carrying the burning liquid on its surface may run thereby spreading the fire. Proper overflow pipes or special drainage will usually take care of this, but the use of heavy hose streams will dislodge the contents of the tank regardless of overflow pipes. Provision for the safe disposal of overflowing liquids is called for where large amounts of water are likely to be used.

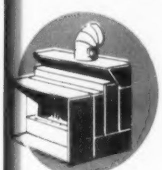
7. Statistics show that automatic sprinklers if sufficiently numerous and well supplied with water can protect dip rooms of moderate area if the tanks are protected in accordance with these standards. With proper drainage from rooms any small amount of overflow can be readily protected by the sprinklers or will quickly burn itself out.

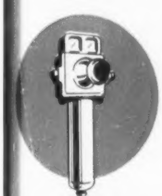
8. There are a great many cases in the fire record where the light spray from the sprinklers has extinguished fires in open dip tanks, which effect has been largely due to the cooling power of the sprinkler spray, but with ordinary sprinklers there is a danger of overflowing the tanks. Special type sprinklers designed to give a fine spray and a limited discharge of water may be advisable.

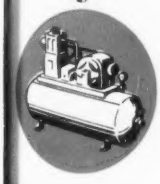
9. The use of hose streams in rooms containing uncovered and unsecured tanks on fire has resulted in serious losses through the displacement of the burning liquids by the water, the heavy streams often splashing the liquid about the room and upsetting the containers. Too much care cannot be taken in using hose lines on such fires. Spray nozzles only should be used.

Classification

10. For the purpose of applying these rules, tanks are divided into three classes. The first two classes assume the use of liquids containing solvents







which may flash at ordinary room temperatures, or heated oils such as are found in hardening and tempering tanks. Where compounds, contained in dip tanks are not of a hazardous nature, these classifications may not apply.

Inspection departments having jurisdiction should be consulted in all cases where there is a question of classification, that the tank protection necessary may be determined.

NOTE. Areas of tanks are to be computed at the level giving the maximum possible area of liquid. The inspection department having jurisdiction should be consulted about tanks of odd shape.

Class A—Tanks exceeding 10 square feet in liquid surface area.

Class B—Small tanks up to 10 square feet in liquid surface area.

Class C—All tanks which do not contain flammable solvents or with solvents having a flash point of over 100° Fahr.

Tanks included in Class C are those containing such compounds that fires in them can be readily extinguished by ordinary means. In this class also may be included such flammables as pitch and tar which may be fairly solid when cool but which are heated in the tanks. Such materials may be heated to such a degree as to warrant their being considered under Classes A or B. When such materials get thoroughly ignited they make very stubborn fires, in many cases involving almost as severe a hazard as those covered in the other sections of these rules.

GENERAL RULES

Location and Arrangement of Process

101. The floor of dipping rooms should be located above grade to provide natural drainage for heavy vapors from the floor, due consideration being given to any probable depth of snow or other obstruction.

102. Extensive dipping processes preferably should be conducted in a detached one-story building or in a cut off one-story section or a location within a fire-resistive building, if the room is thoroughly cut off and otherwise arranged in accordance with the suggestions herein.

NOTE. As a rule, extensive dipping processes with standard automatic protection are safer when located in a large room than when confined as there is less danger of an explosive or combustible mixture being formed in a large room, as the air is usually well circulated by natural means. The smaller the room in proportion to dipping and dipped surfaces exposed, the more readily dangerous conditions are reached. Large values should not be exposed to hazardous processes. The principle of so separating hazards that their fires and resultant damage may be confined strictly to their particular locality is fundamental to good occupancy.

103. In many industries the necessity for conducting dipping processes in ordinary combustible buildings is recognized, but in such case the suggestions herein outlined are to be strictly followed so far as they may apply. Such dipping should be confined to the lesser hazards or small units.

104. Combustible ceilings not equipped with sprinklers should be protected, preferably by cement plaster on metal lath.

105. Combustible contents such as wooden partitions and wooden lockers should be eliminated. Wooden floors should be protected so far as practicable. Dip tanks should be accessible on all sides and the work not crowded, care being taken to minimize the amount of stock in the room that an unnecessarily large loss in case of fire may be avoided.

106. Where it is necessary to conduct these processes in upper stories of buildings, their location above valuable contents should be avoided.

107. Waterproof floors with standard drains or scuppers are advised where practicable to drain floors of areas containing severe dipping hazards.

Storage of Flammable Liquids

108. Flammable liquids necessary to the dipping process shall be stored and handled in accordance with Standards for Containers for Handling and Storing Flammable Liquids. Portable containers if used shall be of an approved type.

NOTE. The use of approved pumps located in rooms or a well supported piping system with an approved pumping arrangement working under a minimum practicable pressure with approved self-closing faucets and return drains is considered safer than handling flammable liquids in portable containers.

109. Empty original containers shall not be stored in or near important buildings. Plugs or covers for empty containers should be left loose to prevent excess pressures.

Control of Hazards

115. Tanks shall be located a safe distance away from furnaces or open flame or spark producing equipment.

116. Electric apparatus in the vicinity of tanks shall be in accordance with Article 500 of the National Electrical Code.

117. Belting should be eliminated, any necessary drives being direct or chain drives in order that the production of static electricity may be minimized. All metal at and in the vicinity of the hazard, including building structures, shall be thoroughly grounded.

Ventilation

118. Ventilation shall be adequate to prevent the accumlation of explosive vapors. Ventilation should be by natural means to outside so far as possible, vents being placed at the ceiling and along the floor through the walls to aid in the natural circulation of air.

NOTE. In addition there should be liberal window area with movable sash, preferably at two different levels, at the top and at the bottom. Natural ventilation by gravity can often be obtained by putting the heating pipes at the ceiling that the air may be warmed to support a high vapor content and pass out through vents at the top of the room. When heat is shut off cold air will then pass in at the top and force the heavier vapors out of the floor vents.

All ventilating systems should conform to the Standards for Blower and Exhaust Systems for Dust, Stock and Vapor Removal.

119. Blowers should be operated for some time after the process is shut down each day to prevent the settling back into the room of heavy vapors, which may be contained in the tubes.

NOTE. In case of fire, blowers which discharge directly outdoors should be operated continuously.

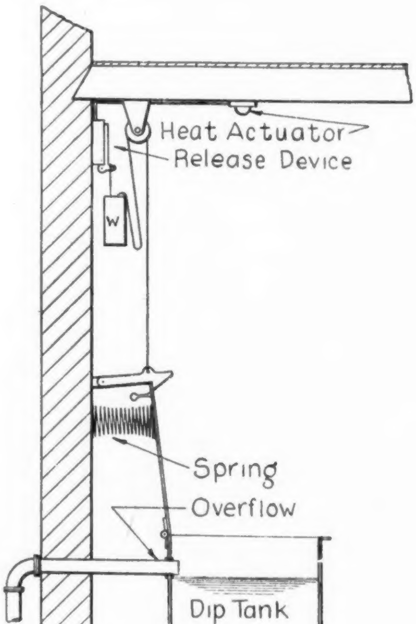


Fig. 3—A Class B dip tank with an automatic cover and an overflow.

Construction and Installation of Tanks

121. Dip tanks and their braces and supports shall be made of heavy metal. Unless of non-ferrous metal they shall be kept painted to avoid the possible production of sparks.

122. Tanks shall be well supported that they may not fall in case of fire through a weakening of the supports, and tanks should be securely fastened in place that they may not upset or be displaced by the use of heavy hose streams.

For tanks extending below the floor into the room below, there should be a non-combustible frame to support the load, flanges of ample width being riveted to the tank and extending well over the frame, unless they are directly supported by a fire-resistive floor.

123. The top of a tank shall be not less than 12 inches above the floor of the room.

124. Drain boards, their supports and other appurtenances should be of non-combustible material.

125. Drain boards shall drain to a closed drain tank (see Rule 197) and not to the dip tank, or the board may be arranged to be moved automatically to prevent conducting water into the dip tank in case of fire.

126. Drain boards shall be kept clean.

Hoods and Curtains

127. Where required by inspection departments having jurisdiction, dip tanks located in rooms equipped with a standard automatic sprinkler system and where tanks are equipped with a standard automatic foam extinguisher system and have no automatic covers or automatic carbon dioxide gas protection, there shall be provided curtains or hoods built of non-combustible materials to deflect water from sprinklers away from the tanks. Hoods or curtains should not include an area substantially larger than the tank and in no case should extend more than 1 foot in any direction beyond the tank except that in some cases it may be desirable to include the drip board or a portion of it in the curtained or hooded area in which case this additional area shall be covered by the automatic extinguishing system which protects the tank. Where dip tanks and dipping machinery are so closely combined as to involve the entire apparatus in one fire, the whole should be considered as one hazard, and special protection provided accordingly.

128. Under combustible ceilings hoods, if used, should be suspended at least 1 foot below the ceiling or bottom of beams or joists in order that

water from sprinklers or hose streams may play over the hood for the protection of the ceiling.

NOTE: Generally the use of hoods in sprinklered areas is not called for where foam is automatically applied as the fires are promptly extinguished before the sprinklers open. Some jurisdictions prefer to have the sprinklers unobstructed as a second line of defense and because sprinklers control dip tank fires under favorable conditions. (See Standards for the Installation of Sprinkler Equipment, Article 713[b].)

Automatic Heat Actuated Devices

129. Heat actuated release devices used to operate automatic covers, drains or automatic extinguishing equipment shall be of approved type. The same heat actuated devices may be utilized to operate two or more forms of automatic protection, subject to the approval of the inspection department having jurisdiction.

130. Where there is a standard automatic sprinkler system heat actuated devices controlling special protection shall be of such type or be so arranged that they will operate sooner than the automatic sprinkler system over the tank and drain board.

First Aid Fire Protection

131. Class B hand extinguishers shall be installed and maintained in accordance with the Standards for First Aid Fire Appliances, or approved foam or carbon dioxide hose systems shall be provided.

(To be concluded in April)

ORGANIC FINISHES and FINISHING IN WARTIME

(*Concluded from page* 180)

asphaltums to the more expensive shatterproof lacquers which prevent injury from breaking glass in case of bombings. This shatterproof lacquer can also be had in unpigmented form but as the danger from air raids in this country decreased, demands for these materials also decreased.

The Future

There is no doubt that if the war continues, civilian use of finishing materials will be still further curtailed. What the organic finishing business will be after the war is problematical, but it seems to the writer that a very rosy future is in sight for everyone in the industry. Demand for household articles, luxuries and needed equipment will be great and all of these will have to be finished and decorated. The trend may be toward bright colors or we may retain the colors which are becoming so familiar today such as the warm drabs, olive greens, blues and earth shades.

There will certainly be a great demand for automobiles, refrigerators and home and office air conditioning units. All these will have to be finished. Whether finishing problems will become more complex due to new plastic materials remains to be seen but organic coatings will be required for plastics. With aluminum production what it is today, we can be assured that more peacetime uses will be found for it and the aluminum articles will have to be decorated to give them sales appeal. Plywood will probably become very popular for houses, furniture and other articles. These will definitely need protection against moisture and will also have to be decorated. Farm equipment, factory equipment and homes will have to be refinished for protection.

Even if future homes are prefabricated in mills, they will require protective coatings and will also need repainting, for continued protection and the desire for colorful homes.

To sum up, it appears that there is plenty of work ahead for all of us, first to win the war and then to cope with new problems after peace is restored.

A Tumble Finishing Questionnaire

By RUFUS J. FAIRBURN

Zapon Div., Atlas Powder Co., North Chicago, Ill.

THIS is another in the series of questions and answers dealing with the application of organic finishing materials. The author, an authority on the subject, covers tumble finishing in all its phases, giving much practical information.—*Ed.*

Question. What is tumble finishing?

Answer. Tumble finishing is a means of coating small parts with lacquer, baking enamel, stain or other finishing materials. The work is placed in a tumble barrel, a small amount of finish is added and the barrel is rotated until the parts are uniformly coated.

Question. What kind of work may be tumble finished?

Answer. Any small part so shaped that there are no deep recesses that need to be coated may be tumble finished. For example, a cylindrical piece is not adapted to tumble finishing if it is desired to coat the interior. Only the exterior of such a piece, where it will rub against other pieces, will be coated. Tumble finishing depends on the rubbing action of one piece against another to distribute the finishing material evenly.

Question. May both wood and metal parts be tumble finished?

Answer. Yes. In addition to wood parts such as tops, small wheels, balls, handles, and similar pieces, metal parts such as bottle caps, small springs, snap fasteners, screws, washers, etc. may be tumbled finished.

Question. What are the advantages of tumble finishing?

Answer. Tumble finishing is economical of finishing material. There is little loss of material such as is encountered in other methods of application. Individual handling of parts is not necessary and a large number of pieces may be finished in a short time.

Question. What type of barrel is used for tumble finishing?

Answer. For tumble finishing metal parts an inclined, open end plating type barrel is used. Special barrels of this type are available.

For tumble finishing wood parts a closed, wood barrel, horizontally mounted, is often preferred. Such a barrel may be cylindrical or have six or eight sides. The six or eight sided barrel provides better tumbling action than a round one. The mass of work is carried up the sides and then cascades back. This rolling action is desirable since it keeps the work apart and prevents sticking. (There would be, of course, less tendency for rounded pieces to stick together than flat ones.)

Question. What size barrel is best?

Answer. For tumble finishing metal parts, any size plating type barrel is satisfactory.

For tumble finishing wood parts, small barrels are not satisfactory. Most wood tumbling barrels are three or more feet in diameter and from three or four feet to ten feet long, depending on the amount of work to be finished per batch.

Question. What is the correct barrel speed?

Answer. The correct barrel speed for either type of barrel is approximately 25 to 30 r.p.m. Slower speeds do not give good tumbling action. Speeds higher than 30 r.p.m. tend to set up centrifugal action and the work does not cascade.

Question. What materials are used for tumble finishing metal parts?

Answer. Some spraying or dipping materials can be used for tumble finishing. However, best results are obtained from materials specifically formulated for this type of application. Baking enamels are usually used although lacquers can be applied by tumbling. Baking enamels are formulated so that they dry tack-free in a few minutes of tumbling. When these materials are baked they tend to flow and eliminate any marring caused in the barrel.

Baking materials for tumble finishing metals are made in white, black and colors. Clear metal finishing materials for tumbling are also made.

Question. What materials are used for tumble finishing wood parts?

Answer. For very rough wood and for pieces with open end grain, highly pigmented tumbling fillers are used. These fillers are so formulated that they do not chalk off during the tumbling operation.

The ideal colored material for tumble finishing wood is lacquer. A base coat of the desired color is applied and a tumble polish is then used to bring up the gloss.

Some wood parts, such as handles, are dipped in stain and then tumbled with clear lacquer. This produces a smooth, natural wood finish.

Question. Is the thinner used important?

Answer. The thinner is most important. It must be a balanced combination to fit the particular material being used and the particular piece being tumble finished. Only the thinner recommended by the finishing material manufacturer should be used.

Question. How much finishing material is needed?

Answer. The amount of finishing material necessary depends on the color of the material being applied, the type of surface being finished, etc. It has been established that about one pint of reduced enamel is required for tumble finishing 48 pounds of steel bottle caps. This is for one coat.

There is a greater variation in the consumption of material in wood tumble finishing than in metal tumble finishing. A soft or open pored wood requires more material than a hard or close grained wood. Maple yo-yo tops require about two quarts of reduced lacquer per thousand.

Question. How full should the barrel be?

Answer. For tumble finishing wood parts, the barrel should not be more than half full. Space must be allowed for the tumbling action.

For tumble finishing metal parts, the inclined barrel should not be more than one-third full.

Question. Should metal parts be cleaned for tumble finishing?

Answer. Yes. Metal parts to be tumble finished must be clean and free from all oil, grease, dirt, etc.

Question. What is the procedure for tumble finishing metal parts?

Answer. A few experimental batches will enable the operator to determine how much material is required per load of parts. After this is established, the process is simple. The parts are dumped into the barrel, the proper amount of material is added and the barrel is rotated until all parts are coated. This requires only a few minutes.

It is desirable to continue tumbling until the material on the parts is tack-free. Drying may be accelerated by directing a jet of air into the rotating barrel. Most tumble finishing materials for metals will set in about ten minutes.

After tumbling, the work is dumped into wire or expanded metal trays and is baked or allowed to air dry. Baking schedules will vary depending on the particular finishing material.

Question. What is the procedure for tumble finishing wood parts?

Answer. The horizontal wooden barrel should be equipped with two doors. One of these is solid. The other is fitted with a screen through which sawdust and shavings are screened out. After the load has been tumbled clean of sawdust and shavings, the screen door is removed, the proper amount of material is poured in, the solid door is put in place and the barrel is rotated.

During the first few minutes of tumbling, the work should be inspected to be certain that enough material has been added to cover the work. It is important to have all the surfaces of the work coated before the material begins to dry.

If the work is not completely coated and the material has begun to dry, any material added may result in a mottled surface.

An excess of material must not be used since this excess must be absorbed before the finishing material will begin to dry. If the work has flat areas, excess lacquer may act as an adhesive, causing the parts to stick together.

After all parts of the work are coated, the solid door is replaced by the screen door. The barrel is then rotated until the finish is thoroughly hard. An additional air dry period of an hour or more is desirable after the work is removed from the barrel.

If a synthetic or oleoresinous material rather than a lacquer is used, the work is handled as if it were metal. The barrel is rotated only long enough to distribute the finishing material over all the parts. The work is then dumped into wire trays for air drying or baking at low temperature.

Question. Is it possible to force-dry wood parts in a horizontal barrel?

Answer. Yes. Warm air may be admitted to the rotating barrel through a hollow shaft. This will shorten the drying time.

Question. What is the appearance of the base coating applied on wood parts?

Answer. The lacquer base coat is often quite dull. Enamel tumble coatings are more glossy.

Question. How is a satisfactory lustre obtained on wood coatings?

Answer. A special tumble liquid polish is used. After this is thoroughly distributed the solid door is replaced by the screen door. A half hour of tumbling will impart a hard glaze to the work.

Question. May a wax polish be used?

Answer. Yes. Carnauba wax or a similar wax may be used, although these do not impart as high a gloss as a special tumble polish.

Question. May a barrel be used for more than one color?

Answer. A metal barrel or a metal lined barrel may be washed out and used for different colors. When wood barrels are used, it is best to use a different barrel for each color. Wood barrels become so heavily coated that it is nearly impossible to clean them.

Question. Can an unsatisfactory finish be removed from wood pieces?

Answer. Yes. Place some thinner-soaked rags in the barrel with the work. Add thinner from time to time until the work is clean. After the wet, dirty rags have been removed, use dry rags in the barrel.

Question. Can flat wood pieces be tumble finished?

Answer. Not as satisfactorily as round pieces. However, some flat pieces can be tumble finished by adding some fairly heavy wood pieces to the load. These break up the mass of flat pieces and prevent their sticking together. Also, tumble the work only for the few minutes needed to distribute the finishing material, dump the load and allow the pieces to dry.

Question. May other coats be applied over a tumble finish?

Answer. It is a frequent practice to smooth and seal wood parts in a tumble barrel. This sealer may be a color coat. A clear or colored lacquer may then be applied by spray or other means.

One of a Series of Articles on Aids in Metal Fabrication

COPPER AS A DRAWING MEDIUM

THE QUICK, PRACTICAL ECONOMICAL METHOD FOR COPPER-COATING STEEL TO FACILITATE DRAWING

Copper has been used as a drawing medium, by the Wire Industry, for a considerable number of years. Originally applied by the electrolytic process—it was later applied by immersion in acid copper sulphate solution, thus obviating the use of electric current. In recent years the American Chemical Paint Company Laboratories developed a more efficient process for applying a copper coating. This method, known as the Cuprodine process, has been widely used for the past five years in wire drawing. Cuprodine produces a better copper coating than was possible by the use of copper sulphate solutions and the wire so treated withstands many more drafts. Parts which have been Cuprodized can often be recoated with Cuprodine without the removal of the previous coating, provided the initial coating has not been oxidized by open annealing.

Drawing Steel Cartridge Cases—A logical development of this new copper coating process, which has proved so satisfactory in wire mills, was its application in drawing steel cartridge cases. Here Cuprodine proved its definite superiority over other lubricating methods. It made unnecessary extensive installations of electro plating equipment, and was found to be exceptionally well adapted to a large-scale, continuous production. Test data available at the present time indicate that it has increased die life from five to ten times that obtained without its use.

The Cuprodine copper coatings are thin (varying from .00002″ to .00005″ in thickness) but very adherent. They have frequently been found to be even more adherent than electro deposited coatings. Like all copper coatings, the rust resistance is limited although their stability is ample for drawing and forming operations (in a further discussion on Cuprotek we will show how Cuprodine coatings can be given considerable corrosion protection).

Requirements for Cuprodine Process. The requirements for good results with this new process are few. The metal must be clean prior to the application of the coating—grease, rust and scale must be absent.

A typical process applied to steel cartridge case cups prior to drawing includes the following steps:

1—Alkali clean.

2—Anneal for thirty minutes at 1300°F.

3—Pickle and rinse thoroughly in running water.

4—Immerse for three minutes in a solution containing 4 oz. of Cuprodine per gallon of 3% by volume 66° sulfuric acid at a temperature of 100°F.

5—Rinse in cold running water.

6—Rinse in hot water containing 10 lbs. per 100 gallons of neutral soap.

7—Dry by means of heat.

This typical procedure can be subjected to many variations. The temperature of the Cuprodine solution can vary from room temperature to 150°F., and the time would be determined in actual operation from the results obtained in drawing.

The Cuprodine bath should be maintained at optimum concentration by additions of acid and Cuprodine. Easily performed titrations determine the constituents of the Cuprodine solution and indicate the additions necessary. This can be done by the workmen on the job.

Tanks should be constructed of sheet lead, or of lead lined steel; however, wood can be used. All of the operations carried out in connection with the coating process are improved by proper agitation. Apparatus of the continuous type is very satisfactory.

The Cuprodine method of copper coating steel and iron has been generally adopted in wire mills and in small arms steel cartridge case plants. There is a large field outside these industries in various types of drawing and forming operations where the efficiency of and economy of this new method should and will be applied. The marked increase in die life, reduction in metal pick-up, improved quality of drawn parts, freedom from scratches and minimized breakage all suggest a careful investigation of the Cuprodine process by all fabricators of drawn parts.

New Equipment

Postwar Primer

A better finish for home, school and office furniture, much tougher than present varnishes or lacquers, is promised after the war by the Finishes Division of E. I. du Pont de Nemours & Co., Dept. OF, Wilmington, Del., it was announced.

A formulation described as "unique" has been developed at the company's laboratories for use as a base or prime coat. Its value, it is said, lies in the extraordinary adhesion it provides for the top coat. The new so-called "penetrating primer," by affording improved "anchorage," permits the use of higher scratch-resistant finishing lacquers. Such super-tough pyroxylin lacquers have long been available, but were impractical because a sufficiently strong adhesive bond with a wood surface could not be obtained.

"The big research problem in utilizing tougher furniture lacquers to resist wear, tear and scratching," explained R. C. Peter, Du Pont Industrial Finishes Division development manager, "is a struggle between cohesion and adhesion. Visualize, for example, a table top to which has been glued sheets of paper and of metal. While it is impossible to strip off the paper, the metal can be removed with little difficulty, despite the fact that the strength of the glue is identical in both instances. The variable here is the difference in the cohesion of the two materials, that is, their ability to hold together.

"When the cohesion of a lacquer film over a surface so exceeds the adhesion, it can be too easily chipped from the underlying surface, as in the case of the metal sheets," said Mr. Peter. "The new first-coat material has a special elastomer, or rubberlike ingredient, that securely binds the top coat to the wood."

Infra-Red Controls

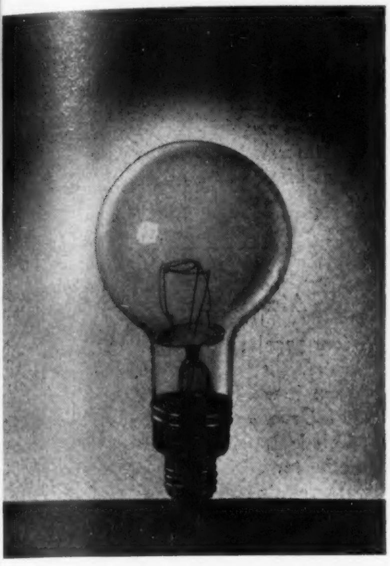
Powerstat continuously variable voltage control by means of which infra-red banks can be immediately and easily adjusted to the correct radiation characteristics for drying and baking operations has been announced by Superior Electric Co., Dept. OF, Bristol, Conn.

According to the manufacturer, it is no longer necessary to change complicated mechanical gadgets for moving infra-red lamps closer to or farther from work when another temperature is required. Push button or manual operation of the Powerstat control instantaneously sets the oven heat. Exacting control, increased efficiency, long lamp life and reduced maintenance and operating costs are claimed for the control system.

Standard types are available for single or polyphase operation on 115, 230 or 440 volt circuits in sizes up to 75 KVA. Bulletins 149 NI and 163 NI are available on request.

Heat-Proof Superlok Construction For Infra-Red Lamps

Birdseye Division of Wabash Appliance Corp., Dept. OF, Brooklyn, N. Y., has announced their new Superlock construction



for permanently locking base and bulb of infra-red lamps, against the terrific temperatures of infra-red tunnel use.

The new Superlock construction of the Birdseye lamp uses no cement or strap in joining the bulb to the base. It includes a base lining made with special protrusions fitting tightly into indentations in the neck of the bulb and locked in position by special crimping of the metal base. The result is a permanently sealed, locked base that is impervious to heat. A ceramic heat reflector disc replaces the mica disc formerly used.

Acid-Type Detergent

Specially designed to facilitate the preparation of steel for organic finishing by providing improved adhesion of the subequent coating of paint, lacquer or other finish, a new acid-type detergent, heretofore restricted to plants doing war work, has just been released for use in all metal working plants by the technical research laboratories of Oakite Products, Inc., New York, N. Y.

Used in many war plants for nearly a year, this development, known as Oakite Compound No. 86, is said to perform three functions in one complete operation. (1) Its effective detergent action removes light spinning compounds, drawing lubricants, machining oils, finger marks, shop dirt, etc. Thus, preliminary alkaline degreasing, often previously required in preparing steel for painting, lacquering or other organic finishing, is eliminated. (2) The material also conditions the surface as it cleans, imparting a microscopic crystalline protective coating on work which assures firm bonding of paint or similar finish. (3) This coating also acts as a rust inhibitor and protects parts against rusting between operations.

Finishing and other production executives may secure a special service report giving complete information by writing to Oakite Products Inc., Dept. OF, 18 Thames St., New York 6, N. Y.

Acid Proof Plastic Coating

Acidulum, an acid proof plastic coating specifically formulated for application to all kinds of metal surfaces, is manufactured by Service Industries, Dept. OF, 2310 W. 74th Ave., Philadelphia, Pa.

According to the manufacturer, this material will not crack or peel at temperatures to 400° F. and will withstand vibration and flexing. Its unusual blanking out quality makes it an ideal coating for all types of metal containers. It conforms to Army and Navy specifications for a coating to be used inside and outside of sulfuric acid wet batteries and also to U. S. Army specification 3-106 E for metal protection.

Acidulum is ready-mixed, requires no stirring and thinning and may be applied by dip, spray or brush. It dries to touch in 15 minutes and hard in 45 minutes to produce a jet black glossy finish. Coverage is 250-350 square feet per gallon.

Industrial Thermometer

A new industrial thermometer with a plastic case front, yellow back, easy reading thermometer tubing and malleable iron back has recently been announced by the C. J. Tagliabue Mfg. Co., Dept. OF, Park and Nostrand Aves., Brooklyn, N. Y.

It is said that by using a plastic case front, weight is reduced and an adequate substitute for metal is provided and that the plastic case front is not affected by the temperatures to which the case is subjected under actual service conditions. Either the glass or the entire front can be replaced at nominal cost.

Yellow back lens front thermometer tubing is claimed to be an improvement over the white back type since the yellow background offers the best color contrast with the mercury.

Manufacturers' Literature

Metal Cleaning and Finishing Machinery Catalog

New data and applications for metal cleaning and finishing machinery—for both war and post-war use—are contained in a new 32-page catalog and manual issued by the *Howard Engineering and Mfg. Co.*, Dept. OF, 1841 Freeman Ave., Cincinnati, O.

Problems involved in cleaning and finishing metal parts are described and illustrated in detail. Information is presented on the various types of cleaning machines, methods and materials. Representative types of the company's machines are shown with detailed analyses of their operations. Sections of the book also describe cooling and drying equipment, and Howard's experimental department services and facilities.

A copy of the catalog will be sent on request.

Paint Catalog

Rust-Oleum Paint Corp., Dept. OF, P. O. Box 110, Evanston, Ill., has issued a 20-page catalog describing the company's finishing materials for indoor and outdoor application to wood, brick, concrete, etc. Based on fish oils which have been specially processed to remove objectionable odors, the materials include a wide variety of colors in a range of glosses which are said to be self-leveling, pliable, resistant to corrosion and most economical because of their good coverage and long life.

Directions for use and information on specific applications, such as on rusted metal, are given in detail and each of the various types of materials produced by the company is described. Color chips are shown for indoor and outdoor paints, aluminum paints, chemical resistant paints, four-hour industrial enamels, concrete enamels and other types.

Copies of the catalog may be obtained on request to the company.

Maintenance Paint Catalog

The Valdura line of heavy duty industrial maintenance paints is now listed in a new catalog issued by the *American-Marietta Co.*, Dept. OF, 43 E. Ohio St., Chicago, Ill. Fully illustrated, the catalog provides application suggestions, product descriptions and technical data. Attractively printed in two colors, it is easily handled and filed. Maintenance men and purchasing agents will find the catalog useful because of the drying, coverage and application information given on the company's products.

Compressor Catalog

Catalog AED-43, recently published by *Schramm, Inc.*, Dept. OF, West Chester, Pa., describes the company's complete line of portable and stationary air compressors. Specifications and illustrations of various models of compressors and motor-compressor combinations are given. Motor-compressor units shown include those equipped with gasoline and Diesel engines and electric motors. Specifications give such data as bore, stroke, number of cylinders, operating speeds, etc. of motors; volume and pressure of air delivered from compressors; horsepower required for maximum delivery and similar information.

Copies of this catalog are available on request.

Air Heater Bulletin

A four-page specification bulletin covering air heaters for baking and drying operations has been issued by the Surface Combustion Div. of *General Properties Co., Inc.*, Dept. OF, Toledo 1, Ohio. The company's atmospheric heaters, fired by means of atmospheric burners requiring only gas at ordinary distribution pressures, and low pressure heaters, requiring proportioning low pressure burner equipment and air at one pound pressure, are completely described and illustrated with pictures and line drawings. The bulletin also covers control equipment for both types of heaters.

Copies of the bulletin, designated as DAH-43, may be obtained on request to the company.

Patents

Determination of Drying Rates

U. S. Pat. 2,338,129. H. R. Moore, Jan. 4, 1944. A method of determining the rate of drying of a coating which consists in applying a film of the coating in a liquid state to an inclined surface; permitting said film to dry for a pre-determined interval of time; rolling an object down said surface and over said coating under the influence of gravity; and timing the rate of travel of said object down said surface between two pre-determined points.

Turpentine Composition

U. S. Pat. 2,338,802. W. E. Decker, Jan. 11, 1944. A composition of matter comprising a cellulose ether and oxidized and polymerized turpentine, the oxidized and polymerized turpentine being the product of blowing turpentine with a gas containing free oxygen for at least 20 to 60 minutes at a temperature between the initial boiling point of the turpentine and the temperature of excessive discoloration of the turpentine, and the cellulose ether being dispersed in the oxidized and polymerized turpentine, so as to form a substantially transparent and homogeneous, thermoplastic material.

Water-Base Paint

U. S. Pat. 2,336,728. H. W. Hall, assignor to The Dicalite Co., Dec. 14, 1943. In the manufacture of paints having an aqueous vehicle: the step of incorporating in said paint a pigment selected from the group consisting of zinc sulfide and titanium dioxide, a diatomaceous earth filler and citric acid in quantity sufficient to bring the pH value of the mixture of pigment and filler to approximately 7.0.

Coating Composition

U. S. Pat. 2,339,058. G. F. D'Alelio, assignor to General Electric Co., Jan. 11, 1944. A composition comprising (1) a partially polymerized diallyl ester of a dicarboxylic acid selected from the class consisting of saturated alipathic acids and aryl dicarboxylic acids, and (2) an allyl ester.

Varnish

U. S. Pat. 2,339,271. E. B. Kester, assignor to Koppers Co., Jan. 18, 1944. A varnish comprising a resin formed by reacting naphthalene and formaldehyde to resinify the naphthalene and then reacting the resinified naphthalene with a phenol; drying oil and a solvent in the form of a compatible mixture.

Coating Composition

U. S. Pat. 2,339,775. H. F. Ether, assignor to E. I. duPont de Nemours & Co., Jan. 25, 1944. A coating composition comprising a vinyl halide polymer, a light colored pigment and from 1% to 7.5% of material selected from the group consisting of lecithin and cephaline.

Spray Gun Adapter

U. S. Pat. 2,339,379. T. E. Cook, Jan. 18, 1944. In combination, a shell, a series of receptacles in said shell arranged side by side around the axis of the shell, a top for the shell, a spray gun, and means to establish communication between said gun and said receptacles, selectively, comprising a selector rotatable on said top concentrically of said axis, and a hollow mounting for said gun attached to said selector eccentrically of said axis and opening into the gun.

Coating Composition

U. S. Pat. 2,340,322. T. R. Griffith, (Canada), Feb. 1, 1944. A pigmented coating composition for protecting and decorating surfaces having as an essential constituent a solution of the unmelted, masticated heat reaction product of a relatively thinly sheeted mix of rubber and a rubber conversion reagent capable of causing the condensation of rubber when heated with rubber, and comprising a solid salt of a strong acid and water of crystallization, said reaction product having the same carbon and hydrogen ratio as rubber and having more chemical saturation than rubber with an equivalent quantity of elements other than carbon and hydrogen combined therewith, the masticated reaction product being soluble in petroleum solvents for rubber.

Business Items

John C. Oberender, New England sales manager of the *Zapon division of the Atlas Powder Company*, Stamford, retired February 1, after 25 years service with the company.

Mr. Oberender joined the company in 1918 as a salesman. He was promoted to assistant manager of the firm's Chicago office, and later became assistant and manager of the New Haven office. Subsequently he went to the general office at Stamford.

Mr. Oberender is a prominent member of the American Electroplaters' Society and has attended nearly all of their conventions. He is also a member and past officer of the International Fellowship Club.

Mr. George K. Graves has been appointed Director of Automotive Sales of *Jones-Dabney and Co.*, with headquarters in Detroit.

Mr. Graves is a graduate of Penn State with a degree in Chemistry. After one year of research work, he became Technical Advisor on lubricating oils for Standard Oil of Indiana. For the past sixteen years, he has been in the sales department of Ditzler Color Co., the last eight years of which he has been assistant sales manager.

Hercules Powder Co. has announced the appointment of *George A. Paine* as district manager of the Synthetics Department, New York territory.

Paul L. Lefebvre has been appointed district manager of the Synthetics Department, Chicago territory.

William T. Carey has been appointed to the newly created position of director of sales — transportation finishes, *Pittsburgh Plate Glass Company*, with headquarters in Pittsburgh, *Hershel E. Post*, general sales manager, industrial finishes, Paint Division announced recently.

Between 1928 and 1935 Mr. Carey was the Company's railway paint sales representative in the St. Louis territory and more recently held the same position in the Chicago territory.

A

Abbott Ball Co., Hartford, Conn. 166
Acme Mfg. Co., Detroit, Mich. 27
Alsop Engineering Corp., Milldale, Conn. 28
Alvey-Ferguson Co., Cincinnati, Ohio 192
American Buff Co., Chicago, Ill. 18-19
American Chemical Paint Co., Ambler, Pa. 191
American Nickeloid Co., Peru, Ill. 49
Astle & Co., Inc., H. J., Providence, R. I. 49

B

Baird Machine Co., The, Bridgeport, Conn. 8
Baker, M. E., Co., The, Cambridge, Mass. 47
Beam Knodel, Inc., New York 47
Beckman Instruments Div. National Technical Laboratories, South Pasadena, Cal. 157
Belke Mfg. Co., Chicago, Ill. 39
Binks Mfg. Co., Chicago, Ill. 184-185
Bristol Brass Corp., The, Bristol, Conn. 45

C

Chicago Wheel Mfg. Co., Chicago, Ill. 197
Chromium Process Co., Shelton, Conn. 45
Clinton Supply Co., Chicago, Ill. 47
Codman Co., F. L. & J. C., Rockland, Mass. 18
Columbia Electric Mfg. Co., Cleveland, Ohio 163
Crown Rheostat & Supply Co., Chicago, Ill. 165

D

Darco Corporation, New York, N. Y. 36
Dellinger Mfg. Co., Lancaster, Pa. 194
Detrex Corp., Detroit, Mich. 161-196
Diversey Corp., Chicago, Ill. 11
Dulite Chemical Corp., Middletown, Conn. 20
E. I. Du Pont de Nemours & Co., Wilmington, Del. 25

E

Edmont Mfg. Co., Coshocton, Ohio 170
Egyptian Lacquer Mfg. Co., New York, N. Y. 174
Enthone Co., New Haven, Conn. 3-168-193

G

General Electric Co., Bridgeport, Conn. 16
General Solvents Co., Rochester, N. Y. 192
Gifford Wood Co., New York 188
Globe Machine and Stamping Co., Cleveland, Ohio 35
Green Electric Co., W., New York, N. Y. 41
Greene, Tweed & Co., New York, N. Y. 10
Gumm Chemical Co., Inc., Frederick, Kearny, N. J. Inside Front Cover

H

Hamilton Emery & Corundum Co., Chester, Mass. 45
Handy & Harman, New York 26
Hanson-Van Winkle-Munning Co., Matawan, N. J. 1
Harrison & Co., Haverill, Mass. 166
Harshaw Chemical Co., The, Cleveland, Ohio 6
Hartford Steel Ball, Hartford, Conn. 45
Hay Co., Jacob, Chicago, Ill. 45
Hogaboom, G. B., Jr., & Co., Newark, N. J. 156
Holland & Sons, Inc., Brooklyn, N. Y. 46

I

Illinois Water Treatment Co., Rockford, Ill. 22
Indium Corp. of America, The, Utica, N. Y. 35
Industrial Filter & Pump Mfg. Co., Chicago, Ill. 32-170
International Rust Proof Corp., Cleveland, Ohio 187

K

Kalamazoo Tank & Silo Co., Kalamazoo, Mich. 169
Keystone Emery Mills, Philadelphia, Pa. 163
Kirk & Blum Mfg. Co., Cincinnati, Ohio 30
Kocour Co., Chicago, Ill. 164
Krembs & Co., Chicago, Ill. 45
Kushner, Joseph, New York 28

L

Lacquer & Chemical Corp., Brooklyn, N. Y. 182
Land & Co., L. J., New York 46
Lasalco, Inc., St. Louis, Mo. 34
Lea Mfg. Co., The, Waterbury, Conn. 44
L'Hommedieu & Sons Co., Chas. F., Chicago, Ill. 7
Lupomatic Tumbling Machine Co., New York, N. Y. 45

M

W. D. MacDermid Chemical Co., Bristol, Conn. 159
MacDermid Incorporated, Waterbury, Conn. Inside Back Cover
Magnus Chemical Co., Garwood, N. J. 179
Magnuson Products Corp., Brooklyn, N. Y. 163
Mahon Co., R. C., Detroit—Chicago 198
Manderscheid Co., The, Chicago, Ill. 165-170
McAleer Mfg. Co., Detroit, Mich. 29
Michigan Chrome & Chemical Co., Detroit, Mich. 162
Mid-States Equipment Co., Chicago, Ill. 158
Mine Safety Appliances Co., Pittsburgh, Pa. 24
Mitchell Bradford Co., Bridgeport, Conn. 24
Motor Repair Co., Cleveland, O. 46
Munning & Munning, Inc., Newark, N. J. 45
Mutual Chemical Co. of America, New York, N. Y. 167

N

Nankervis Co., Geo. L., Detroit, Mich. 13
National Sherardizing & Mach. Co., Hartford, Conn. 49
Neilson Chem. Co., Detroit, Mich. 181
Novitsky, Jos., Hollis, L. I., N. Y. 167

O

Oakite Products, Inc., New York, N. Y. 4
Osborn Mfg. Co., Cleveland, Ohio 12

P

Packer Machine Co., Meriden, Conn. 169
Pennsylvania Salt Co., Philadelphia, Pa. 21
Peters-Dalton, Inc., Detroit, Mich. 195
Platers Technical Service Co., New York 156
Plating Equipment & Supply Co., New York 46
Plating Processes Corp., Holyoke, Mass. 30
Platt Bros. & Co., The, Waterbury, Conn. 168
Powers Regulator Co., Chicago, Ill. 170
Precimet Laboratories, New York, N. Y. 45
Pro Mat Division, Poor & Co., Chicago, Ill. 37
Puritan Mfg. Co., Waterbury, Conn. 164

Q

Quinn, Nelson J., Toledo, Ohio 160

R

N. Ransohoff, Inc., Cincinnati, Ohio 18
Robinson, A. & Son, New York 156
Roe, Lewis Mfg. Co., Brooklyn, N. Y. 45

S

Sarco Co., Inc., New York, N. Y. 17
Seymour Mfg. Co., Seymour, Conn. 14
Siefen Co., J. J., Detroit, Mich. 50
Sparkler Mfg. Co., Mundelein, Ill. 22
Spraying Systems Co., Chicago, Ill. 42
Standard Plating Rack Co., Chicago, Ill. 45
Stanley Chemical Co., East Berlin, Conn. 176
Stevens Inc., Frederic B., Detroit, Mich. 5
The Sturgis Products Co., Sturgis, Mich. 9

T

Tamms Silica Co., Chicago, Ill. 49

U

Udylite Corp., The, Detroit, Mich. 33
United Chromium, Inc., New York 31-40
U. S. Galvanizing & Pltg. Equipment Corp., Brooklyn, N. Y. 42
U. S. Stoneware Co., Akron, Ohio Back Cover

V

Vonnegut Moulder Corp., Indianapolis, Ind. 190
Vulcan Detinning Co., The, Sewaren, N. J. 45

W

Waterbury Rolling Mills, Inc., Waterbury, Conn. 168
Whittaker, Clark & Daniels, Inc., New York, N. Y. 32
Wyandotte Chemicals Corp., J. B. Ford Division, Wyandotte, Mich. 23
Wyandotte Paint Products, Rackote Division, Wyandotte, Mich. 15

Z

Zapon Division, Atlas Powder Co., New York and Stamford, Conn., & North Chicago, Ill. 172

« « ODDS and ENDS » »

Bible Class Dept:

One of our well wishers, who forgot to include his name, mailed us the following gem which may help some metal finisher's sister or daughter understand her boy friend's preoccupation:

23rd Psalm of an Engineer's Sweetheart

Verily, I say unto you, marry not an ENGINEER, for an engineer is a strange creature, and possesseth of many devils. Yea, he speaketh eternally in parables, which he calleth formulae, and he wieldeth a big stick which he calleth a slide-rule, and he hath only one Bible, a hand-book. He thinketh only in serious aspects and seemeth not to know how to smile. And he picketh his seat in a car by the springs therein, and not the damsel. Neither doth he know a waterfall save by its power, nor a sunset except by her live weight. Always he carrieth his books with him, and entertaineth his sweetheart with steam tables. Verily, though his damsel expecteth chocolates when he calleth she openeth the package, but to disclose samples of iron ore. Yea, he holdeth his damsel's hands, but only measureth the friction, and his kisses are but to test her viscosity. For in his eyes there shineth a far-away look, that of neither love nor longing—rather a vain attempt to recall the formulae. When his damsel writeth of love and signeth with crosses, he taketh not these symbols for kisses, but rather for unknown quantities. Even as a boy, he pulleth girls hair but to test its elasticity. His marriage he taketh as a simultaneous equation, involving two unknowns, and yielding diverse results.

So sayeth I, marry NOT an Engineer.

The lady of the house, reading the above over our shoulder, made only the comment, "NOW they tell me!!" Undoubtedly overwhelmed with remorse at the hurt look in our eyes, she later volunteered the information that since the 23rd Psalm is the one read before an execution, the title of the item was therefore inappropriate, to say the least,—which indeed did comfort us.

Incidentally, why do people say that a man is *practicing* the profession of engineering?? And we saw an ad in the *New York Times* offering the services of experienced *floor engineers* who will come in and wax and polish your floors. Aren't we engineers versatile? Aren't we?

Live and Learn Dept:

It may surprise both of our steady readers, as it did us, to learn that the *metric* system is the standard in the United States, contrary to common belief. The yard is defined as a certain fraction of a meter and the pound as a fraction of a kilogram.

For years, electrochemically minded individuals have worked on methods for removing broken drills from holes by dissolving them out anodically. Now *Ohio Crankshaft Co.* comes along with a method to beat all methods. *They blast the drills out with dynamite*, so help us!!

Pig iron received its name from the molds in which it was cast. The molds resembled a litter of suckling pigs. A long ton of iron weighed 2268 lbs. in the old days instead of 2240 lbs. The difference was the estimated weight of the sand picked up from the sand molds employed at the time.

A 300 ampere/30 volt airplane generator may weigh as little as 45 lbs.—about one-tenth the weight of a standard generator.

Poem of the Month:

Don't say the thing's impossible,
For chances are you'll rue it.
For some darn fool who doesn't know,
Will come along and do it.